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East Europe Report

SCIENTIFIC AFFAIRS

No. 716

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BRIEFS

PRAGUE TROPICAL AGRICULTURE STUDIES--The Institute of Tropical and Subtropical Agriculture attached to the College of Agriculture in Prague-Suchdol celebrated its 20 years of existence on 11 September. Over 450 students from Europe, Asia, Africa and Latin America have graduated from the institute, and 29 of them have returned for postgraduate studies. Hundreds of Czechoslovak graduates have been involved in working on agricultural projects in developing countries, and 43 research studies, primarily concerning these countries, have been completed during the past 20 years. During the Sixth Five-Year Plan [1976-1980], about 350 Czechoslovak agricultural experts went to Africa, Latin America and Southeast Asia to participate in various agricultural projects and also to serve in the capacity of instructors and advisers. In 1980, 12 Czechoslovak veterinarians participated in a large cattle health recovery program in Angola, where the CSSR Government made available vaccines and laboratory equipment free of charge. In Laos, the possibility of large-scale hog breeding has been studied; Burma has asked for an expert on the cultivation of hops; Sudan has asked for food technology experts and Peru for an agricultural construction designer. Mexico, which intends to establish agricultural-industrial centers, has invited experts on agricultural products processing. During the past several years, Czechoslovak experts have trained agriculturists in poultry breeding, fodder processing and fishery in Algeria. [Prague ZEMEDELSKE NOVINY in Czech 12 Sep 81 pp 3, 8]

CSO: 2402/80

GERMAN DEMOCRATIC REPUBLIC

OVERVIEW OF 'DECENTRALIZED DATA TECHNOLOGY' PRODUCT OFFERINGS

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 17 No 9, Sep 80 pp 7-10

/Article by Dr Werner Schulze, VEB Robotron Marketing, East Berlin: "Basic Concept of the 'Decentralized Data Technology' Product Program." More detailed descriptions of these products and their operating systems are published elsewhere in this same JPRS issue/

/Text/ The "Decentralized Data Technology" product program is composed of coordinated individual units, complex units, and application complexes for the acquisition, storage, transmission, preparation, and processing of data. Complex units and application complexes have their own control and processing capability to various degrees (based on microcomputers) and include system-documentation components.

An essential characteristic of the "Decentralized Data Technology" product program is its modular design, which is based on

a uniform technical base (including the microcomputers utilized)

a uniform design and format (uniform basic design)

standardization and compatibility of the data media utilized

programmability at several control levels

modular operating systems.

The design provides overall standardization in the total product program. The utilization and application of the same basic technical solutions and logical-functional basic principles offers the user the advantages of good configurability and adaptability to specific problems. Furthermore, these features lead to simplified development of system documentation.

1. Devices of the 'Decentralized Data Technology' Product Program and Their Applications

Tables 2 and 3 list the application complexes, complex devices, and the peripheral devices that are important for the user (external memories, I/O devices) of Series I of the product program, together with their essential characteristics. The control and processing capability required for application complexes and complex devices is formed from the modules of the microcomputer systems K 1520 and K 1600. Table 1 contains the modules utilized. Table 2 gives the control cores used in the individual terminal units.

Table 1: Microcomputer Modules From the Product Program 'Decentralized Data Technology'

Microcomputer System	Module	Technical Data
K 1520	Central computer unit K 2521	8 bit, n-MOS switching circuit 3 K byte PROM, 1 K Byte RAM
	Central computer unit K 2525	Like K 2521, 8 K byte PROM
	Central computer unit K 2526	Like K 2521, two processors, 1 K byte RAM
	Storage modules	RAM, PROM, ROM maximum addressible capacity: 64 K byte
K 1600 -Microcomputer K 1620	Central processing unit K 2662	16 bit, n-MOS switching circuit
	Storage modules	Maximum addressible capacity: 64 K byte (32 K words)
-Microcomputer K 1630	Central processing unit K2663	16 bit, n-MOS switching circuit
	Storage management unit K 2061	
	Arithmetic processor K 2062	Like K 2663, special microprograms
	Storage modules	Maximum addressible capacity: 256 K byte (128 K words)

Lfd. Nr. 0	Gerätebezeichnung A	Chiffre B	Steuerkern (ZRE) C	Ausstattung (Peripherie) D	Systemunterlagen E	Anwendungsgebiete F
Bürocomputer						
1	Bürocomputer	A 5110	K 2526	siehe Tab. 4	Betriebssystem SIOS 1526	vorzugsweise für Buchungs- und Abrechnungsaufgaben, blattorientierte Datenerfassung, Minimaltextverarbeitung
2	Bürocomputer	A 5120	K 2526	siehe Tab. 4	Betriebssystem SIOS 1526	dialogorientierte Datenerfassung, Stapeldatenübertragung, einfache Buchung und Abrechnung, Minimaltextverarbeitung
3	Bürocomputer	A 5130	K 2526	siehe Tab. 4	Betriebssystem SIOS 1526	universell einsetzbar für Buchung, Fakturierung, Abrechnung, dialogorientierte Datenerfassung, Nebenbeitextverarbeitung, Konvertierung von Dateien zwischen verschiedenen Datenträgern
Datenerfassungsgeräte						
4	Belegleser	A 5210	K 2521	Kassettenmagnetband, Folienspeicher	problemorientierte Standardsoftware	automatische Erfassung alphanumerischer informationen von Belegen
5	Datensammelsystem	A 5220	K 2526	Datenstationen, Magnetbandgerät, DFÜ-Anschluß, Seriendrucker, Bildschirm	Betriebssystem SIOS 1526	Mehrplatzsystem zur Erfassung von Massendaten auf Magnetdatenträger
Daneben Einsatz spezialisierter Konfigurationen der Bürocomputer A 5110, A 5120 und A 5130						
Textsysteme						
6	Elektronisches Schreibsystem (Grundmodell)	A 5310	K 2526	Alphanumerische, numerische und Funktionstastatur, Folienspeicher, Seriendrucker, Bildschirm, DFÜ-Anschluß	Betriebssystem SIOS 1526 problemorientierte Programmpakete	Textbearbeitung, Dateiverwaltung
6a	Elektronisches Schreibsystem (erweitertes Modell)			zusätzlich: Minifolienspeicher, Drucker		Textbearbeitung, Textverarbeitung und Dateiverwaltung in vollem Umfang
Basisrechnersysteme						
7	Kommerzielles Basisrechnersystem	A 6401	K 1620	siehe Tab. 4	Betriebssystem MOOS 1600, LAOS 1600, problemorientierte Programmpakete	wissenschaftlich-technische und kommerzielle Datenverarbeitung im Solobetrieb oder in Kopplung mit EDVA
8	Kommerzielles Basisrechnersystem	A 6402	K 1630	siehe Tab. 4	wie A 6401	wie A 6401, jedoch entsprechend der höheren Leistungsfähigkeit
9	Terminalorientiertes Basisrechnersystem	A 6421	K 1620	wie A 6401	wie A 6401	wie 6401, 6402 – Nutzerkommunikation über eine Vielzahl von Terminals
10	Terminalorientiertes Basisrechnersystem	A 6422	K 1630	wie A 6402	wie A 6402	
11	Prozeßrechnersystem	A 6491	K 1620	siehe Tab. 4	wie A 6401	automatische Prozeßsteuerung, Labor- und Prüffeldautomatisierung, Echtzeitaufgaben im prozeßgekoppelten Betrieb mit unterschiedlichen Leistungsanforderungen
12	Prozeßrechnersystem	A 6492	K 1630			
Weitere problemorientierte Basisrechnersysteme befinden sich in Vorbereitung						

O Lfd. Nr.	Gerätebezeichnung A	Chiffre B	Steuerkern (ZRE) C	Ausstattung (Peripherie) D	Systemunterlagen E	Anwendungsgebiete F
Terminals und OEM-Erzeugnisse						
13	Mikrorechnerentwicklungssystem	A 5601	K 2521	Folienspeicher, Lochbandeinheit, Tastatur, Seriendrucker, Bildschirm	Betriebssystem MEOS	Programmentwicklung für das Mikrorechnersystem K 1520
14	Mikrorechnersystem	K 1520		Moduln (Baugruppen für OEM-Einsatz)		Grundlage für Finalerzeugnisse auf Mikrorechnerbasis
15	Mikrorechnersystem	K 1620		Moduln (Baugruppen für OEM-Einsatz)		
16	Mikrorechnersystem	K 1630		Moduln (Baugruppen für OEM-Einsatz)		
17	Konzentrator	K 8521	K 2521	fest programmiert		Übertragungs- und Leitungssteuerung, Nachrichtensteuerung, Netzsteuerung
18	Multiplexor	K 8523	K 2521			
19	Konzentrator	K 8561	K 1630	problemorientierte Standardprogramme		programmierte Übertragungs- und Leitungssteuerung, Nachrichtensteuerung, Netzsteuerung, Aufgaben der DFV
20	Multiplexor	K 8563	K 1630			
21	Bildschirm-ein-/ausgabegerät	K 8911	K 2521	Bildschirm, Tastatur, DFÜ-Anschluß	fest programmiert	Bedieneinheit, Dialogterminal für Nahverkehr
22	Bildschirmterminal	K 8912	K 2521	wie K 8911	fest programmiert	Dialogterminal für Fernverkehr
23	Datenstation	K 8913	k 2521	wie K 8911	fest programmiert	Einsatz in Datensammelsystemen
24	Platzreservierungsterminal	K 8927	K 2526	alphanumerische und Funktionstastatur, Bildschirm, Seriendrucker, Folienspeicher DFÜ-Anschluß	problemorientierte Standardprogramme	Bedienplatz für Reservierungsaufgaben in Fernverarbeitungssystemen), einschlägige Dialogverarbeitung
25	Universelles Bildschirmterminal	K 8931	K 2526	wie A 5120	Betriebssystem SIOS 1526 spezielle Applikationsprogramme	Dialog- und Stapelverarbeitung in Fernverarbeitungssystemen
26	Druckerterminal	K 8951	K 2526	Tastatur, Seriendrucker, DFÜ-Anschluß, Bildschirm		dezentrales Auslistgerät und blattorientiertes Eingabegerät

Table 2: Complex Devices and Application Complexes of the Product Program "Decentralized Data Technology"

Key:

0	Running Number
A	Device Designation
B	Symbol
C	Control Core (ZRE)
D	Equipment (Peripheral)
E	System Documentation
F	Application Areas

Office Computers

1A	Office computer
1D	See Table 4
1E	Operating System SIOS 1526
1F	Preferably for bookkeeping and billing tasks, page-oriented data acquisition, minimal text processing

2A	Office computer
2D	See Table 4
2E	Operating System SIOS 1526
2F	Conversational mode-oriented data acquisition, batch data transmission, simple bookkeeping and billing, minimal text processing

3A	Office computer
3D	See Table 4
3E	Operating System SIOS 1526
3F	Universally usable for bookkeeping, invoicing, billing, conversational mode-oriented data acquisition, ancillary test processing, conversion of files between various data media

Data Acquisition Devices

4A	Document reader
4D	Cassette tape, floppy disk
4E	Problem-oriented standard software
4F	Automatic acquisition of alphanumeric information from documents

5A	Data collection system
5D	Data stations, tape unit, remote data transmission connection, serial printer, display screen
5E	Operating System SIOS 1526
5F	Multi-station system for the acquisition of mass data on magnetic data media

Also utilization of specialized configurations of office computers A 5110, A 5120, and A 5130

Table 2 Key (continued)

Text Systems

6A Electronic writing system (basic model)
6D Alphanumeric, numeric, and function keyboard, floppy disk memory, serial printer, display screen, remote data transmission connection
6E Operating system SIOS 1526, problem-oriented program packets
6F Text processing, file management

6aA Electronic writing system (expanded model
6aD Additional: mini-floppy disk memory, printer
6aF Text processing, text editing and file management in full scope

Basic Computer Systems

7A Commercial basic computer system
7D See Table 4
7E Operating system MOOS 1600, LAOS 1600, problem-oriented program packets
7F Scientific-technical and commercial data processing in stand-alone operation or coupled with electronic data processing systems

8A Commercial basic computer system
8D See Table 4
8E Like A 6401
8F Like A 6401, but corresponding to higher power

9A Terminal-oriented basic computer system
9D Like A 6401
9E Like A 6401
9F Like 6401, 6402 - user communication through a number of terminals

10A Terminal-oriented basic computer system
10D Like A 6402
10E Like A 6402
10F Like 6401, 6402 - user communication through a number of terminals

11A Process computer system
11D See Table 4
11E Like A 6401
11F Automatic process control, laboratory and test field automation, real-time tasks in process-coupled operation with various power requirements

12A, D, E, F like 11A, D, E, F.

Further problem-oriented basic computer systems are in preparation

Table 2 Key (continued)

Terminals and OEM Products

13A	Microcomputer development system
13D	Floppy disk memory, paper tape unit, keyboard, serial printer, display screen
13E	Operating System MEOS
13F	Program development for the microcomputer system K 1520
14A	Microcomputer system
14D	Modules (modules for OEM use)
14F	Foundation for final products on a microcomputer basis
15A, D, and F	like 14A, D, and F
16A, D, and F	like 14A, D, and F
17A	Concentrator
17D	Fixed programming
17F	Transmission and line control, message control, network control
18A	Multiplexor
18D	and F like 17D and F
19A	Concentrator
19D	Problem-oriented standard programs
19F	Programmed transmission and line control, message control, network control, tasks of remote data processing
20A	Multiplexor
20D	and F like 19D and F
21A	Display screen input/output unit
21D	Display screen, keyboard, remote data transmission connection
21E	Fixed programming
21F	Operating unit, conversation mode terminal for local traffic
22A	Display screen terminal
22D	Like K 8911
22E	Fixed programming
22F	Conversational mode terminal for remote traffic
23A	Data station
23D	Like K 8911
23E	Fixed programming
23F	Use in data collection systems

Table 2 Key (continued)

24A	Space reservation terminal
24D	Alphanumeric and function keyboard, display screen, serial printer, floppy disk memory, remote data transmission connection
24E	Problem-oriented standard programs
24F	Operating station for reservation tasks in remote data processing systems, relevant interactive mode processing
25A	Universal display screen terminal
25D	Like A 5120
25E	Operating system SIOS 1526, special application programs
25F	Conversation mode and batch processing in remote processing systems
26A	Printer terminal
26D	Keyboard, serial printer, remote data transmission connection, display screen
26F	Decentralized listing unit and page-oriented input unit

The application complexes and complex devices can be arranged in groups, in dependence on their principal application area:

- Office computers
- Data acquisition devices
- Text systems
- Basic computer systems
- Terminals and OEM products.

This product program also includes devices for the construction of subsystems for remote data processing (especially for computers of the ESER (Uniform System of Electronic Computer Technology)).

Such a subdivision can only give a rough orientation. It is very problemmatical precisely because of the strict modular character and overall programmability of the product program. Thus, text processing is implemented not only with the electronic text-processing system A 5310 but naturally also with the office computers A 5110, A 5120, and A 5130 or the basic computer systems A 6401 or A 6402 - appropriate system documentation and hardware equipment being presupposed. Precisely the office computers are interesting from this perspective, since they provide economical, job-related, autonomous units for integrated data and text processing. Small and medium businesses thus have novel possibilities for solving their information-processing problems. Table 2, in the column "Equipment" includes types of peripheral equipment, but Table 3 specifies the particular devices that are actually used in the product program, together with their essential parameters. Especially the basic computer systems exhibit a multiplicity of possible applications. Based on the K 1620 and K 1630 microcomputers, and based on various complements of peripheral devices and system documentation, computer systems are created which are adapted to the particular application:

- commercial basic computer systems A 6401 and A 6402 (batch-oriented)
- terminal-oriented basic computer systems A 6421 and A 6422 (transaction-oriented)
- process computer systems A 6491 and A 6492.

It is expected that this assortment will be expanded with other problem-oriented basic computer systems.

The devices listed in Table 3 mainly involve products of the VEB Combine Robotron or other combines of the GDR. The remaining devices are procured from other CEMA countries in virtue of international cooperation. The technical preconditions for this were created with the joint work on the system of minicomputer technology.

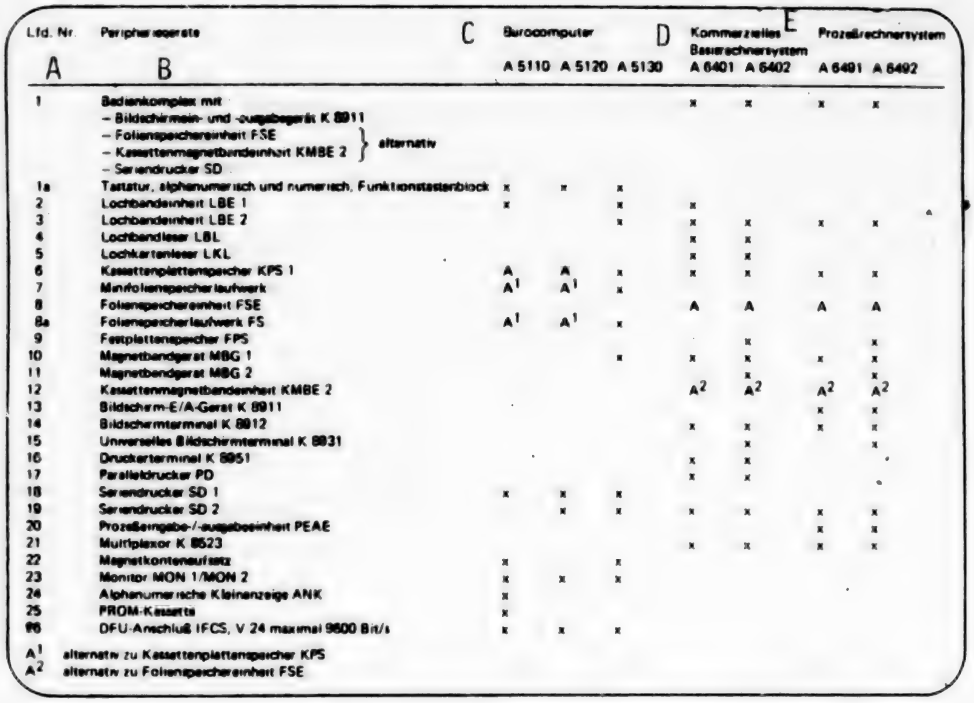
Table 3: External Memories and I/O Devices of the Product Program 'Decentralized Data Technology'

Running No.	Designation	Abbreviation	Technical Data
1	Cassette tape unit	KMBG	6/12 k bit/s
2	Cassette tape unit	KMBE 1	Two KMBG (for K 1520)
3	Cassette tape unit	KMBE 2	Two KMBG (for K 1600)
4	Tape unit 12.7 mm	MBG 1	10 k byte/s; 32 bit/mm
6	Fixed disk memory with connection control	FPS	35 M byte
7	Mini-floppy disk memory	MFS	About 100 K bytes unformatted, or about 80 K bytes formatted, 125 k bit/s
8	Mini-floppy disk unit	MFSE 1	Two MFS
9	Floppy disk	FS	3.2 M bit; 250 k bit/s
10	Floppy disk unit	FSE	Two FS with control device
11	Cassette disk memory	KPS 1	One fixed disk and one cassette disk; each 25 M bits
12	Punched card reader	LKL	600 cards per minute
13	Paper tape unit	LBE 1	-LBL: 350 characters/s 5...8 channels -LBS: 50 characters/s
14	Paper tape unit	LBE 2	LBL: 500/1000 characters/s; depending on reader type 1000/2000 characters/s; depending on reader type LBS: 50 characters/s
15	Paper tape reader	LBL	- 1500 characters/s, 5...8 channels
16	Serial printer	SD 1	- Character inventory: 96 35 characters/s -closed writing -132 characters per line or 210 characters per line
17	Serial printer	SD 2	-character inventory: 96 -400, 200, 100 characters/s -mosaic printer - 136 or 210 characters/line
18	Parallel printer	PD	-850 or 478 characters/min with 64 or 96 characters respectively -132 characters per line

Table 3 (continued)

Running No.	Designation	Abbreviation	Technical Data
19	Keyboard	AN 1	Keyboard for printer-oriented devices
20	Keyboard	AN 2	Keyboard for display screen-oriented data acquisition devices and sit-down work stations
21	Keyboard	NF	Combined and function keyboard primarily in combination with AN 1 and AN 2
22	Keyboard	ANF	Keyboard for display screen-oriented terminals
23	Display screen monitor	MON 1	31 cm screen diagonal 1024 characters, 16/24 lines, 64/80 characters/line character grid: 7 x 10 character inventory: 128
24	Display screen monitor	MON 2	31 cm screen diagonal 1920 characters, 24 lines, 80 characters per line character grid: 7 x 10/5x8
25	Alphanumeric mini-display	ANK	One block with 32 places - 64 characters
26	Process input/output device on a microcomputer basis	PEAE	Module assortment for analog and digital input/output, etc.

Table 4: Peripheral Devices (Basic Spectrum) for Office Computers and Basic Computer Systems



Lfd. Nr. A	Peripheriegeräte B	C Bürocomputer			D Kommerzielles Basisrechnersystem		E Prozeßrechnersystem	
		A 5110	A 5120	A 5130	A 6401	A 6402	A 6491	A 6492
1	Bedienkomplex mit – Bildschirmein- und -ausgabegerät K 8911 – Folienspeichereinheit FSE } alternativ – Kassettenmagnetbandeinheit KMBE 2 } alternativ – Seriendrucker SD				x	x	x	x
1a	Tastatur, alphanumerisch und numerisch, Funktionstastenblock	x	x	x				
2	Lochbandeinheit LBE 1	x		x	x			
3	Lochbandeinheit LBE 2			x	x	x	x	x
4	Lochbandleser LBL				x	x		
5	Lochkartenleser LKL				x	x		
6	Kassettenplattenspeicher KPS 1	A	A	x	x	x	x	x
7	Minifolienspeicherlaufwerk	A^1	A^1	x				
8	Folienspeichereinheit FSE				A	A	A	A
8a	Folienspeicherlaufwerk FS	A^1	A^1	x				
9	Festplattenspeicher FPS					x		x
10	Magnetbandgerät MBG 1			x	x	x	x	x
11	Magnetbandgerät MBG 2					x		x
12	Kassettenmagnetbandeinheit KMBE 2				A^2	A^2	A^2	A^2
13	Bildschirm-E/A-Gerät K 8911						x	x
14	Bildschirmterminal K 8912				x	x	x	x
15	Universelles Bildschirmterminal K 8931					x		x
16	Druckerterminal K 8951				x	x		
17	Paralleldrucker PD				x	x		
18	Seriendrucker SD 1	x	x	x				
19	Seriendrucker SD 2		x	x	x	x	x	x
20	Prozeßeingabe-/-ausgabeeinheit PEAE						x	x
21	Multiplexor K 8523				x	x	x	x
22	Magnetkontenaufsatz	x		x				
23	Monitor MON 1/MON 2	x	x	x				
24	Alphanumerische Kleinanzeige ANK	x						
25	PROM-Kassette	x						
26	DFÜ-Anschluß IFCS, V 24 maximal 9600 Bit/s	x	x	x				

A^1 alternativ zu Kassettenplattenspeicher KPS
A^2 alternativ zu Folienspeichereinheit FSE

Key:

A	Running Number
B	Peripheral Devices
C	Office Computers
D	Commercial Basic Computer System
E	Process Computer System
1	Operator complex with - display screen input and output unit K 8911 - floppy disk unit FSE {alternative - cassette tape unit KMBE 2 {alternative - serial printer SD 1
1a	Keyboard, alphanumeric and numeric, function key block
2	Paper tape unit LBE 1
3	Paper tape unit LBE 2
4	Paper tape reader LBL
5	Card reader LKL
6	Cassette disk memory KPS 1
7	Mini-floppy disk drive
8	Floppy disk unit FSE
8a	Floppy disk drive FS
9	Fixed disk memory FPS
10	Tape unit MBG 1
11	Tape unit MBG 2
12	Cassette tape unit KMBE 2
13	Display screen I/O unit K 8911
14	Display screen terminal K 8912
15	Universal display screen terminal K 8931
16	Printer terminal K 8951
17	Parallel printer PD
18	Serial printer SD 1
19	Serial printer SD 2
20	Process input/output unit PEAE
21	Multiplexor K 8523
22	Magnetic ledger card supplement
23	Monitor MON 1/MON 2
24	Alphanumeric mini-display ANK
25	PROM cassette
26	Remote data transmission connection IFCS, V 24 maximum 9600 bit/s

A^1 Alternative to cassette disk memory KPS

A^2 Alternative to floppy disk unit FSE

PHOTO CAPTIONS

1. p 7. Office Computer A 5110 With Magnetic Ledger-Card Attachment
2. p 9. Office Computer A 5110 With Display Screen and Floppy Disk
3. p 10. Office Computer A 5120
4. p 10. Office Computer A 5130
5. p 10. Space-Saving Terminal K 8927

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CSO:2302/9

GERMAN DEMOCRATIC REPUBLIC

COMMERCIAL BASIC COMPUTER SYSTEMS ROBOTRON A 6401, A 6402 DESCRIBED

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 17 No 9, Sep 80 pp 11-14

/Article by Manfred Gruenewald, VEB Robotron Center for Research and Technology, Dresden: "Commercial Basic Computer Systems Robotron A 6401 and A 6402"/

/Text/ The basic computer systems A 6401 and A 6402 are special application-related configurations of the microcomputer system K 1600. The different configuration possibilities of the microcomputer system K 1600 make it possible to furnish basic computer systems for various tasks.

The microcomputer system K 1600 with the microcomputers K 1620 and K 1630, which are constructed on the basis of modern, highly integrated n-MOS microprocessor circuits, is a component of Series II of the uniform system of minicomputers (SKR) with the Model No. CM 50/50-2.

The technical advantages of the new system are its great compactness, low cost, high reliability, and functional universality.

The new microcomputer system is oriented towards very broad application. Besides its use as a commercial basic computer system A 6401 and A 6402, it can be used

in the area of automatic production control

in laboratory and test-panel automation

in large remote data processing systems for controlling data channels and terminals as well as for line-concentrator functions

as terminal-oriented basic computer system

for other control functions, etc.

1. Capabilities of the Microcomputers K 1620 and K 1630

The basis for the multiple capabilities is

the uniform, modular structure of all system components

a broad performance and price variation of the system components with respect to processing power, connection possibilities, memory equipment, and system performance

the constructive design which makes it possible to install modules into the standard vessels of the "uniform vessel system" (EGS) and into vessels corresponding to the CEMA standard as well as to build up complete computers

the programming and connection compatibility to the SKR

the expansion capability of the modules.

The general system architecture of the microcomputer system K 1600 (Figure 1) provides for all the system components (processor, memory modules, connection controls, and coupling units) being connected through a common bus. All the functional units of the computer communicate with one another over this common bus, the system bus K 1600. Besides the system bus K 1600, the computer also has the SKR unit bus and the processor-internal bus K 1630. The SKR unit bus guarantees the connection of peripheral units and connection control units with the SKR unit bus interface through a bus converter.

The processor-internal bus K 1630 is used to connect an additional arithmetic processor to the K 1630.

The microcomputer K 1620 is a model of the medium power class. It is intended as a built-in computer for work as an integrated problem-oriented computer in technical installations, e.g. for tool-machine control, or as an independent complete computer to solve universal control and information-processing problems.

The K 1620 differs from the more powerful model K 1630 primarily by its smaller addressing area of 32 K words (K 1630 - 128 K words) and by a computing power that is less by 20 to 25 percent.

Table 1 shows the common features and differences of the two computer models.

An essential characteristic of the K 1630 consists in its being upgraded with an arithmetic processor. This allows the rapid processing of 32/64-bit floating point numbers and of 16/32-bit fixed point numbers.

Table 1: Performance Parameters of the Computers K 1620, K 1630, K 1630 (With Arithmetic Processor)

	K 1620	K 1630 (Without Arithmetic Processor)	K 1630 (With Arithmetic Processor)
Processing width	16 bit parallel, word/byte processing		Fixed point: 16 and 32 bit Floating point: 32 and 64 bit
Number representation	Fixed point, two's complement		
Number of instructions	about 400	about 400	about 400 + 30 more basic instructions
Instruction system	SKR basic instruction system with supplements		
Control principle	Microprogram control		
Addressing types	12	12	12 + 8
Number of universal registers	8	8 (for user-) + 8 (for system-programs)	An additional 9 of these 4 can be freely selected by the programmer
Addressing Areas	32 K words, of these 28 for memory, 4 for I/O device registers	128 K words, of these 124 for memory, 4 for I/O device registers	
I/O organization	Interrogation, interrupt, or DMA traffic		

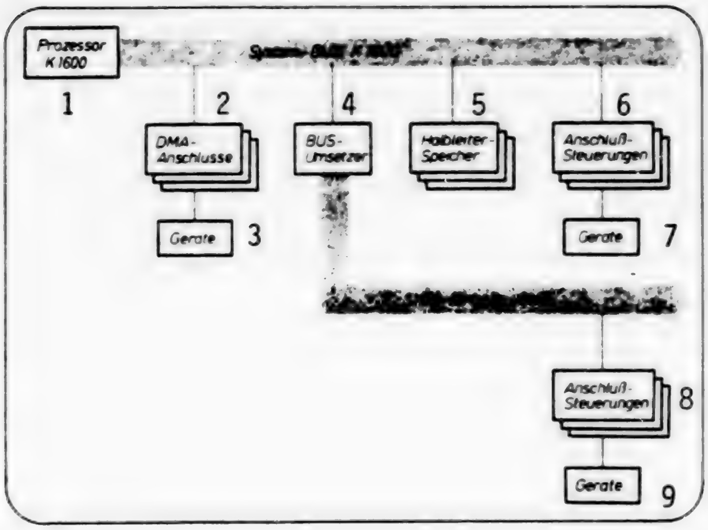


Figure 1: Architecture of the Microcomputer System Robotron K 1600
Key:
1. Processor K 1600
2. DMA connections
3. Devices
4. Bus converter
5. Semiconductor memory
6. Connection controls
7. Devices
8. Connection controls
9. Devices

The microcomputer system K 1600 uses various storage modules based on semiconductor circuits. These involve

programmable read-only memories (PROM)
random access memories (RAM)

where the latter are primarily used in the system K 1600.

The capacity of the PROMs is 8 K words, and that of the RAMs is 2, 32, and 128 K words.

A reduction is possible in steps of 2 K with the 8-K PROM, and steps of 4 K with the 32-K RAM, and in steps of 16 K with the 128-K RAM.

2. Configuration Possibilities of the Commercial Basic Computer Systems Robotron A 6401 and A 6402

The possible applications result from

the variable storage capacity up to 28 K words (with the Model A 6401) and up to 128 K words (with the Model A 6402)

the large number of connectable different peripheral devices

the possibility of autonomous use as well as use as an "intelligent" terminal with an ESER (uniform electronic data processing system) computer, where again it is generally possible to connect terminals to the basic computer systems

the provision of a powerful operating system and problem-oriented system documentation.

In principle, an installation (Figure 2) includes the operating unit, which consists of a display screen with an alphanumeric keyboard, a decimal and function keyboard, to which a serial printer is generally connected. A data-media input/output unit (cassette unit, paper tape reader, or floppy disk drive) is likewise required.

This equipment allows a new operating concept such as also exists e.g. with larger electronic data processing systems, namely the concentration of operator activity on the display screen. Working with the display screen offers the following advantages:

a faster working mode as compared to the typewriter because of the faster reaction of the system and the possibility of faster reaction on the part of the operator

improved an simplified operator guidance

noiseless work

more trouble-free operation

better and simpler tests.

If desired, a printer can be connected in parallel with the work on the display screen in order to produce permanent records.

Besides the products of the VEB Combine Robotron, devices from the Hungarian People's Republic, The People's Republic of Bulgaria, Czechoslovakia, and the Polish People's Republic are also used as external units.

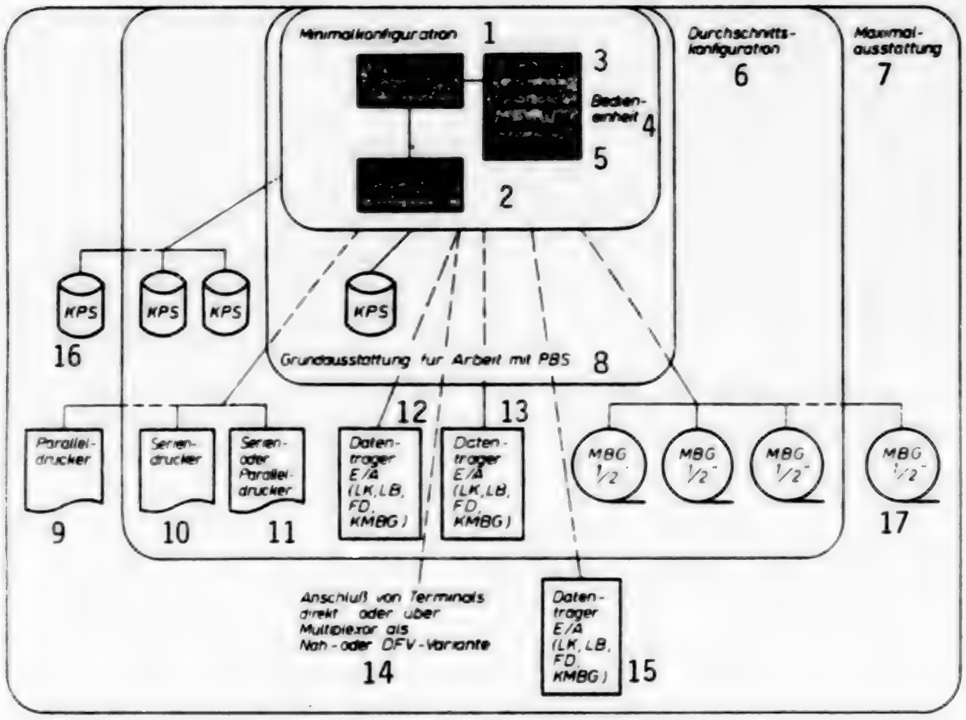


Figure 2: Configuration Possibilities of the Commerical Basic Computer Systems

Key:

1. Minimal configuration
2. Data medium I/O
3. Display screen + keyboard
4. Operating unit
5. Serial printer
6. Average configuration
7. Maximum equipment
8. Basic equipment for work with PBS (peripheral operating system)
9. Parallel printer
10. Serial printer
11. Serial or parallel printer
12. Data medium I/O (punched card, paper tape, floppy disk, cassette tape)
13. Data medium I/O (punched card, paper tape, floppy disk, cassette tape)
14. Connection of terminals directly or through multiplexor as local or remote data processing variant
15. Data medium I/O (punched card, paper tape, floppy disk, cassette tape)
16. Cassette disk memory
17. Tape unit 1/2 inch

Table 2 shows the peripheral equipment that is primarily intended for connection.

The following devices are thus primarily used as external memories:

- tape memory units (1/2" and cassette units)
- cassette disk memories.

The use of fixed-disk memories is also planned.

Besides the possibility of connecting 1/2" tape units, the performance capability is significantly determined by the disk memories. These memories offer the possibility of direct access to larger amounts of data.

Numerous applications can be processed only with direct access to large amounts of data. These include problems of inventory management, information retrieval in the conversational mode, etc.

Floppy disks can also be used as external memories.

With the input and output peripheral equipment, the starting point is to satisfy as many user needs as possible. Thus, paper tape and punched card units are furnished for users who work with paper tape or punched card input and who have built up their entire operating organization on these media. These users thus have the possibility of continuing their previous organizational principles. The cassette tape units and floppy disk memories also permit the use of modern data media for input.

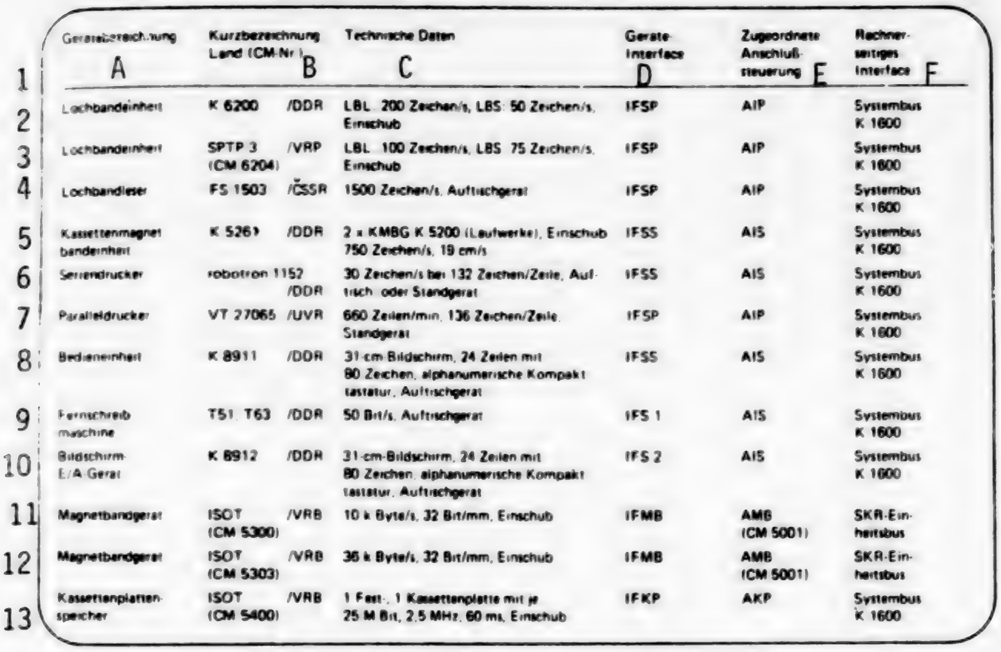
Serial printers and parallel printers with various capabilities are available for printed output.

The following terminals of the VEB Combine Robotron can be connected to the commercial basic computer systems. These are currently in development within the framework of the product program "Decentralized Data Technology":

display screen input and output unit
universal ("intelligent") display screen terminal
printer terminal
data station
data acquisition unit
office computer
electronic text processing system.

All the devices listed above are connected through appropriate adapters (connection controls to the system bus of the K 1620/1630 or through the BUS converter at the SKR unit bus.

Table 2: Configuration of the Commercial Basic Computer System Robotron A 6401 and A 6402



	Geratebezeichnung A	Kurzbezeichnung Land (CM-Nr.) B		Technische Daten C	Gerate-Interface D	Zugeordnete Anschluß-steuerung E	Rechner-seitiges Interface F
1							
2	Lochbandeinheit	K 6200	/DDR	LBL: 200 Zeichen/s, LBS: 50 Zeichen/s, Einschub	IFSP	AIP	Systembus K 1600
3	Lochbandeinheit	SPTP 3 (CM 6204)	/VRP	LBL: 100 Zeichen/s, LBS: 75 Zeichen/s, Einschub	IFSP	AIP	Systembus K 1600
4	Lochbandleser	FS 1503	/ČSSR	1500 Zeichen/s, Auftischgerat	IFSP	AIP	Systembus K 1600
5	Kassettenmagnetbandeinheit	K 5261	/DDR	2 x KMBG K 5200 (Laufwerke), Einschub 750 Zeichen/s, 19 cm/s	IFSS	AIS	Systembus K 1600
6	Seriendrucker	robotron 1152	/DDR	30 Zeichen/s bei 132 Zeichen/Zeile, Auftisch- oder Standgerat	IFSS	AIS	Systembus K 1600
7	Paralleldrucker	VT 27065	/UVR	660 Zeilen/min, 136 Zeichen/Zeile, Standgerat	IFSP	AIP	Systembus K 1600
8	Bedieneinheit	K 8911	/DDR	31-cm-Bildschirm, 24 Zeilen mit 80 Zeichen, alphanumerische Kompakttastatur, Auftischgerat	IFSS	AIS	Systembus K 1600
9	Fernschreibmaschine	T51, T63	/DDR	50 Bit/s, Auftischgerat	IFS 1	AIS	Systembus K 1600
10	Bildschirm-E/A-Gerat	K 8912	/DDR	31-cm-Bildschirm, 24 Zeilen mit 80 Zeichen, alphanumerische Kompakttastatur, Auftischgerat	IFS 2	AIS	Systembus K 1600
11	Magnetbandgerat	ISOT (CM 5300)	/VRB	10 k Byte/s, 32 Bit/mm, Einschub	IFMB	AMB (CM 5001)	SKR-Einheitsbus
12	Magnetbandgerat	ISOT (CM 5303)	/VRB	36 k Byte/s, 32 Bit/mm, Einschub	IFMB	AMB (CM 5001)	SKR-Einheitsbus
13	Kassettenplattenspeicher	ISOT (CM 5400)	/VRB	1 Fest-, 1 Kassettenplatte mit je 25 M Bit, 2,5 MHz, 60 ms, Einschub	IFKP	AKP	Systembus K 1600

Key:

1A Device designation
1B Abbreviation country (CM-Number)
1C Technical data
1D Device interface
1E Associated connection control
1F Interface on the computer side

2A Paper tape unit
2B K 6200 /GDR
2C LBL: 200 characters/s LBS: 50 characters/s, insert
2F System bus K 1600

3A Paper tape unit
3B SPTP-3 (CM 6204) Polish People's Republic
3C LBL: 100 characters/s, LBS: 75 characters/s, insert
3F System bus K 1600

4A Paper tape reader
4B FS 1503, Czeckoslovakia
4C 1500 characters/s, desktop unit
4F System bus K 1600

5A Cassette tape unit
5B K 5261 GDR
5D 2 x KMBG K 5200 (drives), insert, 750 characters/s, 19 cm/s
5F System bus K 1600

6A Serial printer
6B Robotron 1152 GDR
6C 30 characters/s for 132 characters/line, desktop or stand-alone unit
6F System bus K 1600

7A Parallel printer
7B VT 27065, Hungarian People's Republic
7C 660 lines/min. 136 characters per line, stand-alone unit
7F System bus K 1600

8A Operating unit
8B K 8911 GDR
8C 31 cm display screen, 24 lines with 80 characters, alphanumeric compact keyboard, desktop unit

Table 2 Key (continued)

9A	Telex machine
9B	T41, T63, GDR
9C	50 bit/s, desktop unit
9F	System bus K 1600
10A	Display screen I/O unit
10B	K 8912 GDR
10C	31 cm display screen, 24 lines with 80 characters, alphanumeric compact keyboard, desktop unit
10F	System bus K 1600
11A	Tape unit
11B	ISOT (CM 5300) People's Republic of Bulgaria
11C	10 K bytes/s, 32 bits/mm, insert
11F	SKR unit bus
12A	Magnetic tape unit
12B	ISOT (CM 5303), People's Republic of Bulgaria
12C	36 k bytes/s, 32 bits/mm, insert
12F	SKR unit bus
13A	Cassette disk memory
13B	ISOT (CM 5400) People's Republic of Bulgaria
13C	1 fixed; 1 cassette disk each with 25 M bit, 2.5 MHz, 60 ms, insert
13F	System bus K 1600

Besides the connection controls for device-specific interfaces, there are adapters for the internationally coordinated interfaces such as IFSS, IFSP, and S2 (V.24). With IFSS (serial), it is possible to manage a distance up to 500 m at a transmission rate up to 9,600 bits per second.

Larger distances are possible with a lower transmission rate.

Because of the multiplicity of the peripheral devices, the system can be equipped in very differentiated fashion, corresponding to user needs.

As a system with minimum equipment, e.g. with

- an operating unit (display screen and keyboard)
- serial printer
- cassette tape unit or floppy disk,

a commercial basic computer system makes contact with the office computers from the point of view of performance. In such a configuration it can be used e.g. for scientific-technical calculations, for which only a little external storage capacity is needed.

In a maximum configuration, e.g. with

- 1/2" tape units
- disk memories
- parallel printers
- terminals,

the basic computer systems reach the performance of the smaller systems of the ESER.

3. System Documentation for the Commercial Basic Computer Systems A 6401 and A 6402

System documentation is being developed and made available for the microcomputer system K 1600. The following are useful for the commercial basic computer systems:

operating system MOOS 1600
CROSS system documentation
problem-oriented system documentation
a technology for the efficient development of system documentation.

4. Examples of Applications

The system is comparable in its size category with the Robotron 4201 computer, which at this time is still in production, but it surpasses this computer with respect to the peripheral equipment that can be connected and with respect to the performance capability of the operating system.

Three possible applications:

Use as an Autonomous Computer in the Computer Center of an Industrial Business

On the basis of its performance data, the commercial basic computer system can be used for computational problems in a small-to-medium industrial business.

Thus, for example, the following problems can be solved:

- wage and workforce calculations
- materials economy
- costs and financial calculations
- production planning and guidance.

The working mode can here be fully autonomous. Data acquisition tasks can be processed both on the basis of paper tape and punched card technology and on the basis of data acquisition and preparation technology with connected cassette-tape or floppy disk memories.

The connection of disk memories to the system allows working with copious files, such as are required e.g. in materials economy, in workforce calculations, or in engineering.

Data acquisition terminals can also be connected for data acquisition work which occurs in the context of such problems. The coupling of the commercial basic computer system with a supervening computer, e.g. a computer of the ESER, is also possible through a remote data processing line.

Use as Computer for Room Reservation and Hotel Information

The commercial basic computer system can also be used as a computer for hotel problems, especially room reservations. Because of the capacity of the computer (working-storage size and speed) as well as because of the connectible peripheral equipment (KMBG (expansion unknown), cassette disk memory), it is possible to connect to such a system a large number of hotels with various room categories for a reservation period of several months.

The following taks are here processed

- reservations
- waiting-list processing
- statistics and information
- file maintenance.

The data (reservation wishes) are here primarily inputted through display screen terminals, which are connected directly or through remote data processing equipment.

Use as Electronic Data Processing System in Medicine

The commercial basic computer systems A 6401/A 6402 are also suitable and intended for tasks of patient-related information processing in medium-large hospitals or in component areas of large hospitals. The following task complexes can here be processed:

- patient admission, assignment, and discharge
- patient-related documentation
- medical-statistical evaluations
- optimization of medical diagnosis
- processing of tasks relating to the planning, management, and administration in the hospital.

The processing of these task complexes leans on data banks with the operative, patient-related data inventory and with nonpatient-related information. The data are inputted and the stored data are accessed largely through display screen terminals, which can be set up locally an and remotely.

It is possible to couple the commercial basic computer system with a large-scale central computer.

These three applications show that the basic computer systems practically are not subject to any restriction as regards their application.

PHOTO CAPTIONS

1. p 11. Commercial Basic Computer System A 6401 (Two-Cabinet Variant)
2. p 13. Commercial Basic Computer System A 6401 (Single-Cabinet Variant)

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GERMAN DEMOCRATIC REPUBLIC

MICROPROCESSOR K 1600 AS PROCESS COMPUTER SYSTEM

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 17 No 9, Sep 80 pp 14-16

/Article by Wolfgang Branitz, VEB Robotron Center for Research and Technology, Dresden: "Microprocessor K 1600 As Process Computer System"/

/Text/ Production of the Robotron 4000 family will shortly run out, but the need for automatic production control, laboratory and test-panel automation, as well as other real-time systems will continue to rise in the eighties. Consequently, process computer systems of the medium power class must be developed on the basis of the microcomputers K 1620 and K 1630. Based on the variable equipment of the microcomputers K 1620 and K 1630 with peripheral units and system documentation, "basic computer systems" are being offered for various power requirements and various application areas.

The application variants are supported, among other things, by the design of the Ursadat 5000 within the system Ursatron 5000. This utilizes the technical capabilities of microprocessors and other microelectronic components to construct a new device generation with qualitatively higher characteristics. With the new capabilities, new applications naturally also open up, which previously did not exist, for technical or economic reasons, with process computers based on the Robotron 4000 computer family. Thus, the new process computer systems now can e.g. be easily decentralized, where the basic units Ursadat 5000, which are directly located at the process, contain the microcomputer K 1520 and thus take over the acquisition of measured values, the output of control values, and the primary processing.

Main Use Variants for Process Computer Systems

Complete process computer systems of various capabilities and configurations

Process guidance computer for hierarchically structured automation systems

Combined use as process computer and mini-data-processing system.

1. System Survey of Process Computer Systems

1.1. Overview

The process computer system is an application-oriented configuration consisting of a computer, operating equipment, and peripheral devices and system documents. In dependence on the configuration and the application characteristics associated therewith, the following process computer systems are being offered:

A 6491 - complete process computer system with Ursadat 5000 and microcomputer K 1620

A 6492 - complete process computer system with Ursadat 5000 and microcomputer K 1630

Another variant as process guidance computer based on the microcomputer K 1630 without Ursadat is anticipated.

1.2. Microcomputer K 1600 and Peripheral Equipment

The microcomputers K 1620 and K 1630 form the core of the process computer systems (PRS). Peripheral units are connected to them, and these units are identical with those for the commercial basic computer systems. The PRS have a device spectrum that differs from the commercial basic computer systems only by their capability of additionally connected the process input/output unit Ursadat 5000.

1.3. Process Input/Output Unit Ursadat 5000

1.3.1 Structure

The basic unit is the basic element of the Ursadat 5000. This represents a universal, modular, expandable unit based on the microcomputer system K 1520, including associated memories, process input/output modules, connection possibilities for data processing peripheral equipment, and interfaces for information transmission. The connection to the K 1600 is established through a fast serial interface, to which several Ursadat basic units can be connected (Figure 1).

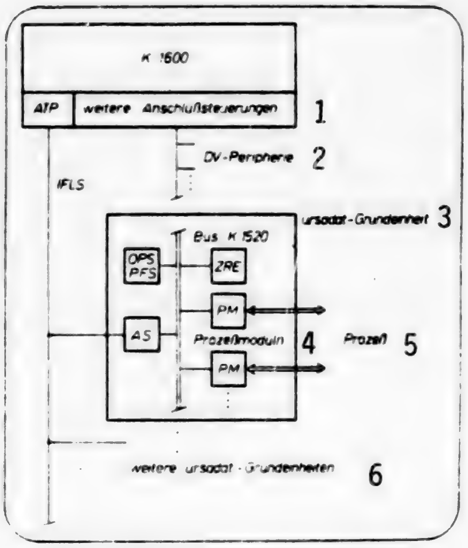

Figure 1: Structure of the Process Computer System
Key:
1. Further connection controls
2. Data processing peripheral equipment
3. Ursadat basic unit
4. Process modules
5. Process
6. Further Ursadat basic units

1.3.2. Interface

Information between the computers K 1620/1630 and the Ursadat basic units is exchanged through the IFLS (interface line-shaped, serial, ASU TP). This is characterized by the following technical parameters:

- Transmission rate:	500 k bit/s
- Effective data rate:	about 120 k bit/s
- Transmission range:	maximum 3 km
- Line:	2-wire transmission over coaxial cables with transformer couplings of the stations
- Transmission:	serial, synchronous, bi-phase-difference-modulation.

At most 100 m can be spanned with the local variant, which operates without modulation.

In terms of devices the IFLS is implemented in the K 1600 through the connection control ATP, which is connected to the system bus K 1600. It is possible to connect a maximum of 60 basic units (25 with the local variant). This number is reduced because of the effective data transmission rate of the IFLS and because of specific use conditions. It depends strongly on the particular application.

1.3.3. Transmission of Information

The transmission of information between the computer and the basic units occurs by means of limited bit sequences (transmission frames) byte-serially with a maximum of 250 data bytes, on the basis of the HDLC procedure (High Level Data Link Control Procedure).

The transmission frame has the following structure:

Synchronization byte/address byte/function byte/data byte/two-byte control section/synchronization byte.

> The synchronization byte is used to delimit and synchronize the frame.
>
> The address byte contains the address of the receiving station.
>
> The function byte characterizes, among other things, the station type, the format, and the procedure.
>
> The data comprise at most 250 bytes, where the number of data bytes is specified in the first data byte.
>
> The two-byte control section is formed according to the polynomial $X^{16} + X^{12} + X^5 + 1$.

Depending on the function of a station at the IFLS, three different station types can be distinguished:

central
control station
controlled station.

The central specifies which station is the control station and what happens by transmitting a transmission frame with the corresponding station address and the identification in the function byte. The control station makes a connection with a controlled station and thus initiates data transmission. The controlled station sends an acknowledgment to the control station. If the control station has effected all the required transmissions, it reports this to the central, so that the central can specify a new control station.

The K 1600 is always a central and a control station. The basic units Ursadat 5000 are thus always controlled stations and cannot exchange information among one another. In case of trouble with the K 1600, a computer provided for this contingency (K 1600, K 1520) can take over the function of the control station.

1.3.4. Ursadat Basic Unit

The basic unit (GE) is the basic element of the process input/output unit Ursadat 5000. Its basis is formed by the microcomputer system K 1520. Each GE contains as its central part a microcomputer K 1520 and the corresponding memory modules. Depending on the project, these are supplemented by process modules, further modules of the K 1520 system, and the connection control for the interface IFLS. All are connected to the K 1520 bus. The GE consists of one or two module supports in EGS (uniform vessel system) design. Every module support has available 23 slots for printed circuit boards, of which a maximum of 16 can be used for process modules. All together no more than 25 process modules (with connection to the K 1520 bus) can be connected to each GE. Each GE has its own power supply.

Process Modules:

- analog input/output	(AE/AA)
- digital input/output	(DE/DA)
- pulse input/output	(IZ/IA)
- frequency measurement	(IZ)
- incremental output	(IA)

Except for the AE, a module is identical with a printed circuit board /1/.

1.3.5. Process Modules

Analog input AE:
- Quantity measured:
  Voltage
  0...10/20/50/100 mV
  0...1/10 V
  Current   bipolar
  0...5/10/20 mA
  and life-zero signals
  Remote resistance meter
  Resistance thermometer
- Information width: 11 bits + sign.

The AE is divided into the AE basic card with 8 inputs and maximally 2 expansion cards each with 24 inputs. Adapter cards are connected before the inputs, with 8 inputs per card with current inputs and 10-V voltage inputs or respectively 4 inputs per card with resistance inputs, mV-inputs, and inserted isolation amplifiers (Figure 2).

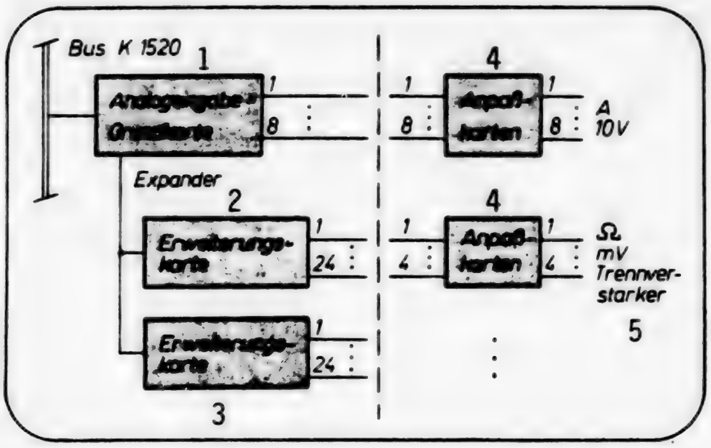

Figure 2: Analog Input Ursadat 5000
Key:
1. Analog input basic card
2. Expansion card
3. Expansion card
4. Adaptation cards
5. Isolation amplifier

Analog Output One Channel AA-1 K:
9 bit + sign
0....10 V, -10...+10 V
0....5 mA, 1...5 mA, -5...+5 mA
0....20 mA, 4...20 mA
It is possible to change over to an external analog value.

Analog Value Output Five Channels AA-5 K:
8 bit + sign
0....10V, -10...+10 V
0....5 mA, -5...+5 mA
No DC isolation possible.

Digital input static DES
Digital input dynamic DED
Digital output multiplex DEM
16 bits per module for DES and DED, 16 x 8 bits for DEM.

Digital output, static and dynamic:

through transistor DA-T	32 bits
through optocoupler DA-O	16 bits
through relays DA-R	24 bits
through reminant relay DAS-H	8 bits (only static)

Digital input/output DEAS:
6 x 4 bits (in stages of 4 bits, programmable as input or output).

Pulse counter IZ:
32-bit information width
The IZ can be used as a pulse counter, timer, and frequency meter with various information widths.

Pulse output IA:
2 x 8 bits as time signal output or as pulse output.

1.4. System Documentation

The operating system MOOS 1600 and the cross section POS have been developed for the PRS (process computer systems). The operating system EIOS can be used in the Ursadat basic units. The channel software for operating the process modules is included in the control program EIEX 1521. It can be generated in correspondence with application requirements. Furthermore, programs for the acquisition and processing of measured data as well as for outputting control values on the Ursadat basic units operate under the control of the EIEX.

2. Application of the Process Computer Systems

The application of the PRS will be illustrated by a particular application which is currently in preparation at the Central Institute for Nuclear Research in Rossendorf /2/. This application can be regarded as representative for automation systems in flow processes (e.g. power plant engineering, chemistry). It furthermore has the characteristics of systems for laboratory automation.

The following automation tasks should be solved at the Rossendorf Research Reactor:

- displaying the process status on display screens
- process monitoring
- digital control of reactor power
- start-up/shutdown and power change
- analysis of interferences
- analysis of accidents
- control of the charging and discharging of radiation samples
- supporting physical experiments
- using methods of room diagnostics

Figure 3 gives an overall view of the structure of the PRS that is used here.

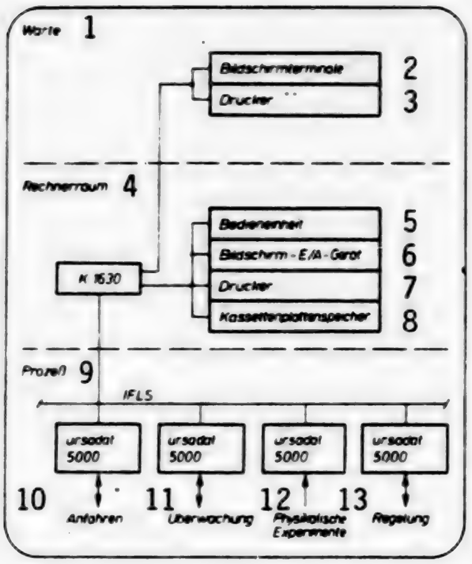

Figure 3: Basic Structure of the Process Computer System of the Rossendorf Nuclear Research Center

Key:

1. Control room
2. Display screen terminals
3. Printer
4. Computer room
5. Operating unit
6. Display screen I/O unit
7. Printer
8. Cassette disk memory
9. Process
10. Start-up
11. Monitoring
12. Physical experiments
13. Regulation

Its core is the K 1630 with its data processing peripheral equipment. The connection to the process is made through several Ursadat basic units, which are associated with particular automation tasks. The process information for the system operator is displayed through the display screen terminals at the console, and the interactive mode conversation is also carried out there.

The division of tasks between the Ursadat 5000 and the K 1630 will be illustrated by the process monitoring and by the display of the process status.

The Ursadat is used for the following tasks:

time-cyclical interrogation of measured data
time-cyclical primary processing with the components
- plausibility test
- dimensioning
- monitoring of limit values
- storing of the prehistory
- calculation of statistical quantities (e.g. averages)
- corrections of measured data
- calculation of derived quantities (e.g. temperature difference)

composition of current data from measurement points into blocks with easy access
treatment of interferences with initiation of an alarm
treatment of spontaneous signals from the process.

The following tasks are processed by the K 1630:

processing the dialogue inputs
taking over current data from measurement points and alarm messages from the basic units
preparing and updating the pictures which characterized the process status
storing the current process status for use in other task complexes
preparation and output of various records.

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DESCRIPTION OF MOOS 1600 OPERATING SYSTEM

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 17 No. 9, Sep 80 pp 17-20

/Article by Claus Rossberg, VEB Robotron Center for Research and Technology, Dresden: "Operating System MOOS 1600"/

/Text/ While the basic computer systems A 6401 and A 6402 are primarily used for economic calculations, the process computer systems A 6491 and A 6492 work as complete process computer systems or as process control computers.

Because of these application areas, there sometimes are different requirements for the particular operating system that is used for the computer. When the computer is used as a commercial basic computer system, work with files occupies the foreground. On the other hand, its use as a process computer system generally requires fast reaction to process events and a well-developed organization for executing user programs.

These requirements are fulfilled by the modular operating system (BS) MOOS 1600. From its module inventory, it is possible to generate operating systems with various use characteristics and capabilities.

The BS MOOS 1600 furnishes not only direct support for applications of the K 1600 computer but also provides extensive technological means for the production and testing of user programs. The development of the BS MOOS 1600 had the objective of guaranteeing, at the level of user programs, compatibility to the corresponding operating systems of the SKR (minicomputer systems).

In addition to the BS MOOS 1600, the BS LAOS 1600 is also being developed. This is especially suited for computer systems with a smaller configuration and for the needs of laboratory and test panel automation.

1. Applications Area

The operating system (BS) MOOS 1600 consists of a set of modules and programs from which one can generate operating systems that are memory-resident both internally and externally for

automatic production control
data acquisition systems
mini-data processing systems
laboratory and test panel automation

It is also possible to generate operating systems for applications in boundary situations of the above-mentioned areas or for their overlaps.

A special position is here occupied by operating systems that are internally memory-resident and which have been generated from MOOS 1600. These systems are not designed for program developments. For this purpose, operating systems memory-resident on disk and generated from MOOS 1600 are more suitable.

In designing the MOOS 1600, an important role was played not only by fast reaction time to real-time requirements but also by the possibility of multiprogramming. Accordingly, MOOS 1600 is oriented towards application areas which extend from its use as an independent process control system to its use as a multi-user system.

The BS MOOS 1600 is developed step by step. Several editions are intended, of which the preceding one is always completely contained in the next one. The performance scope of the first two editions has already been designed.

2. Components of the BS MOOS 1600

The essential components of the BS MOOS 1600 are the following:

- executive MOEX 1600
- macroassembler (MAC)
- compiler for
  - FORTRAN IV (FOR)
  - COBOL (COB)
  - CDL (Compiler Description Language)

- task builder (TKB)
- editor (EDI)
- library editor (LBR)
- test program (DEP)
- file access routines (FCS)
    - sequential and direct access
    - command-times interpreter
- file transfer program (PIP)
- file test program (VEY)
- file print program (DMP)
- file save and compression program (DSC)
- file conversion program (FLX)
- paper tape input program (PTI)

The BS MOOS 1600 consists of the executive program (control program) and the system programs, which work under the control of the executive program.

The system programs are used for program development and translation, to execute special system management functions, for working with files and for input/output support.

The system programs use all disk files, and therefore presuppose an operating system resident on disk memories. The collaboration of various system programs to produce a runnable user program is shown in Figure 1, using as an example an assembler program written in MACRO 1600.

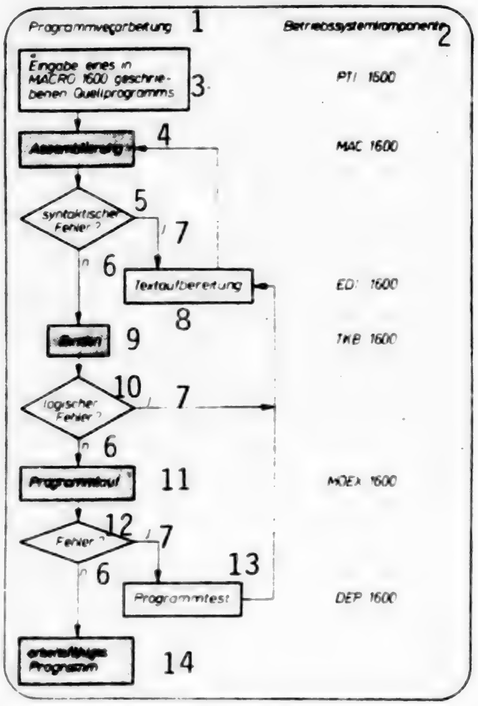

Figure 1: Sequence for the Production or a Runnable Program, Written in MACRO 1600

Key:
1. Program generation
2. Operating system component
3. Input of a source program written in MACRO 1600
4. Assembly
5. Syntactical errors?
6. No
7. Yes
8. Text preparation
9. Linkage
10. Logical errors?
11. Program execution
12. Errors?
13. Program test
14. Runnable program

3. Basic Functions of the System Programs

The Macroassembler translates source programs which are written in the assembler language MACRO 1600. It offers the capability of conditional assembly. This allows the translation of program sections in dependence on values of certain variables, which are specified at assembly time, or to exclude such program sections from translation. Global symbols can establish the connection among program modules that have been translated independently of one another. It is possible to output a CROSS reference list.

The FORTRAN compiler implements the FORTRAN IV standard as well as several extensions that are convenient for the users. FORTRAN programs can use nearly all executive instructions, and specifically through subprograms of the system library. Besides the translation list, a storage allocation table and a list of the generated code can also be outputted. The programming of test lines is provided for logical error search. This can be translated as instructions or commentary. A running-time system monitors the processing of FORTRAN programs and indicates errors that may have occurred. In the case of errors that occur in subprograms, the cause is traced back into the calling program.

There are two versions for COBOL:

a strongly reduced version for the K 1620, that is compatible with K-1520 COBOL

a version for the K 1630, which essentially includes the full scope of the COBOL standard.

Here COBOL 1620 is a subset of COBOL 1630. The COBOL 1630 compiler (COB 1630) and the programs generated by COB 1630 cannot run on the K 1620.

The CDL programming system facilitates effective working with the system programming language CDL 1600. It consists of a library compiler for translating macrolibraries, a CDL compiler for translating CDL-1600 modules, and a running-time system.

The CDL language was specially created for the development of compilers. However, it is suitable for many user problems because of the following characteristics:

It forces programming with a tree structure.

It makes possible a modular program structure.

It guarantees high effectiveness of object programs with respect to running time and storage space.

It has a high degree of self-documentation.

Despite the problem-oriented programming level, it permits a good connection with the actually used computer system.

The CDL language is also used, for example, in the development of POS modules.

CDL has only a few but effective means of expression. Certain elementary functions must be written as macros in the assembler language MACRO 1600, so that all the means of expression existing there can be used. The macros are stored in libraries. During translation with the compiler, a target program in the assembler language MACRO 1600 is generated on the basis of a macro library. This target program must be processed further by the assembler.

The task builder processes one or more object modules, which are independent of the programming language used, into executable programs, the tasks, and rolls out a faithful image of storage, the task image file, together with information concerning the task, on the systems residence. The formation of the task is influenced by commands and by the overlay description for the task. In this way, for example, the following can be specified or instigated:

the position of the task in the user program system
access rights to protected data areas
roll-out possibilities in case of an interrupt
the size of cellar areas
the overlay structure of the program
the inclusion of test programs.

Furthermore the task builder can create common areas for data and storage areas for subprograms that are used by several tasks. Besides forming the task, the task builder makes available to the user various information concerning the task, such as a cross-reference list of all global symbols used in the task and a list of all object modules used in forming the task.

The editor can process files (source programs or other text material). For this purpose, individual lines or blocks of lines can be read from an input file into a working storage buffer, can be processed there, and finally can be written into a new output file. The processing takes place both line- and character-oriented. By means of special commands, the second input file can also be opened during the process, and can be selected for accepting text sections. By closing the selected second input file, it is possible to assemble a text from texts of arbitrarily many input files.

The library editor gives the user extensive management capability of object- and macro-library files, which are available to access by the task builder and the assembler. Besides generating libraries, it is possible to erase individual modules, to compress a library that is only partially occupied because of erasures, to detach, insert, rename, and replace individual modules.

By means of the test program, assembler programs can be tested logically if they have been combined into a task together with this test program, by means of the task builder. By setting interrupt points and by interpretive program processing, the following functions become possible:

input and output of storage location and register contents

searching for bit patterns and instructions with particular address references

calculating of offsets, codings, and arithmetic expressions

step-by-step program execution.

The file access routines represent a set of subprograms which are bound to the user tasks and which, within these tasks, implement access to files of the MOOS 1600, as instructed by the macro calls. The I/O operations can be block- or record-oriented. The following access forms are supported:

sequential for files with records of fixed and variable length

freely, with direct addressing for files that have records of fixed length.

While direct access to disk files is possible, work with sequential files can be programmed device-independent.

A command line, which has been inputted by a user through a terminal, can be interpreted, by means of special subprograms, as a sequence of input and output file specifications and switches, which control the operation of the user program with the files of the BS MOOS 1600.

The main task of the file transfer program consists in transporting and copying files. Data can be transported between various units or from one disk area to another. The copying and insertion functions for files, overwriting an existing file with a new one, and adding a file to another one, are here possible. Furthermore, this program can also facilitate tasks without file transport, such as the erasure of files, the output of file indexes, changes in a file index (name, access rights, etc.) and the processing of blocked files.

By means of the file testing program, it is possible to test the status of disk files and to access data which are no longer available for normal access. Furthermore, the number of still free blocks on a disk can be determined and all file names can be printed out.

The file print program permits the output of the content of files or selected portions of files or entire data media in various representational forms.

By means of the file-save and compression program, disk files can be rolled out e.g. onto tape, and files can be moved so as to combine scattered free areas on disks.

The file conversion program allows the conversion of files in various file formats and consequently makes possible the acceptance of data inventories from other operating systems, e.g. from LAOS 1600.

By means of the paper tape input program, data generated on data acquisition devices, such as source programs, can be taken over as files on the disk memory, so as to undergo further processing there.

4. Basic Functions of the Executive Program MOEX 1600

The following overview assembles the basic functions of the executive program MOEX 1600 of the BS MOOS 1600. An "x" indicates the edition of the operating system in which the corresponding basic function is contained. This overview also shows that the generation of operating systems that are internally memory-resident becomes possible only with edition 1.2. It also shows that some basic functions, e.g. a file system, do not exist with operating systems that are internally memory-resident.

The capabilities of the executive program can be used through executive instructions (macros) contained in the tasks or, by the operator, through commands.

	Edition		
	1.1		1.2.
	ex.	int.	ex.
Multiprogramming			
Priority control	X	X	X
Time-sharing	-	-	X
Multi-user operation	-	-	X
Background work for program development	X	-	X
Batch processing	-	-	X
Logical connection of several user programs	X	X	X
Dynamic working storage management	-	X	X
Automatic restart after power failure	-	X	X
Storage protection	-	X	X
Time organization	X	X	X
Support of user-related computer-time determination	-	-	X
Command work	X	X	X
Logical file system	X	-	X
Logical I/O system	X	-	X

	Edition		
	1.1.		1.2.
	ex.	int.	ex.
Indirect outputs for logging units	-	-	X
Reservation of devices and files for			
certain user programs	X	-	X
certain users	-	-	X
Allocation of physical device addresses to logical device designations	X	X	X
Operation of devices	X	X	X

ex. = resident on external memory
int. = resident on internal memory

Multiprogramming

Although only the executive program or a task can at any one time control the CPU (central processing unit), multiprogramming is possible because waiting times arise during the processing of a task (e.g. waiting for the end of an I/O operation). During these times, the executive program can organize the execution of other tasks.

With multiprogramming, it is possible to control a number of tasks that is limited only by practical perspectives. For the control by priority, 850 priority levels are available. The priority can be assigned to the task while it is being structured by the task builder or before it is executed. It can also be changed during execution. The task with the highest priority, which has access to all system capabilities required by it (memory, peripheral equipment), and which itself is not waiting for some event, obtains control of the CPU. Depending on the character of the task to be solved, the priority can achieve a sensible distribution of CPU time among individual tasks.

For various task complexes, a pure priority-controlled execution of tasks is not sufficient, since an approximately equal-priority processing of various component problems becomes possible only by considerable organizational effort on the part of the user. For this reason, a time-slice control can be generated for tasks of equal priority. Normally, these tasks are assigned free CPU time in the sequence in which they report for execution. On the basis of time-slice control, the sequence of these tasks can constantly be interchanged cyclically, however, so that in this fashion each task occupies every place in the sequence during the course of time.

Multi-user Operation

Special monitoring and control functions can be generated for multi-user operation, by means of which the individual users can be monitored and controlled. The users, from their terminals, have restricted rights with respect to the system manager. The latter assigns an identification code to each user, which also specifies the privilege status of the user. Only after inputting an associated identification code and password, can the user make further inputs on his terminal and thus use the system. Access rights to files and devices can be differentially specified for the users. In this way, and through the command inventory that is restricted with respect to a system manager, protection of the users among one another is secured.

Background Work for Program Development

Only operating systems resident in external memories permit program development. All system programs required for this work only with disk files.

Logical Connection of User Programs

For the logical connection of several tasks among one another, common storage areas as well as executive instruction, e.g. for starting a task, are available.

Dynamical Working Storage Management

The storage organization of the MOEX is based on a division of the free working storage into partitions. A task is processed in a partition. A partition is a contiguous storage area, which is identified by its name, type, basis address, and length. MOEX supports two types of partitions, the user-controlled and system-controlled partitions. The user-controlled partition can be subdivided into at most seven subpartitions. It is thus possible, e.g. to alternate the processing of one large task and at most seven small tasks within one partition. The assignment of a task to a user-controlled partition is already done by the task builder. The starting address of the task is equal to the base address of the partition. System-controlled partitions are possible only with systems that are generated for a K 1630 with a storage management unit SVE 30. In this case, the executive routine organizes the storage area allocation so that as many tasks as possible can be located simultaneously in one partition. This dynamic main storage management is based on the utilization of the SVE of the K 1630. The SVE 30 links the addresses of a program (0...32 K words) with the physical addresses of the memory (0...124 K words). If the dynamic working storage management has been generated, each task can begin with the starting address 0 and, through the address linkage via the SVE 30, can be processed in every partition of the memory. The memory is large enough to accept the task. Because of the 16-bit addressing technique of the MRS K 1600, at most 32 K words can be addressed. Since the uppermost 4 K addresses are used to address the peripheral equipment, a task can address at most 28 words directly. Larger tasks can be implemented by resolving the tasks into individual segments of an overlay structure.

Automatic Restart After Power Failure

In case of a power failure, all transitory register contents are saved by MOEX, in order to secure meaningful continuance of work after power recovery. The continuance of work presupposes that the tasks that are provided for continuing the work will have available memories with their data preserved. After the power recovery, the executive routine reestablishes the saved status and prepares the I/O drivers, which were active at the time of the power failure, for continuing their work. User tasks have the opportunity of requesting, by means of an executive instruction, information concerning the power recovery. Following power recovery, the processing of these tasks is then initiated through special entry points.

Storage Protection

Storage protection is again guaranteed only with the K 1630 through the SVE 30.

Time Organization

The date and time of day are furnished through the real-time clock that is present in the computer. Furthermore, a one-time and cyclic program start, immediate and delay program start, as well as time-dependent waiting are possible.

Command Work

Besides the normal command work, it is possible to work with indirect command files. These files are provided for frequently recurring command sequences. When processing these command files, the parameters of the commands contained therein can be updated by the operator (e.g. names of files). This provides a very efficient possibility of processing frequently recurring sequences with a low risk of operator error.

Indirect Outputs

A component can be generated which stores all outputs on a writing unit in a disk file. After completion of the task, the generated file is entered into a queue for the output program of this component. The component can freely be used by all tasks. Thus tasks that work in parallel can use the same logging unit.

Operation of Devices

All devices are operated in interrupt operation. This secures the parallel working of the CPU and the devices. The devices can here be assigned to various priority levels for interrupt handling. The I/O requirements of the tasks are entered into queues that are associated with the devices. Accordingly, the task continues to execute and, at a given time, waits for the end of the I/O request. The task receives information concerning the course of data transmission. Error routines proper to the task are used for error handling. I/O drivers as generable components of the MOEX 1600 are made available for the standard peripheral equipment. Furthermore, the user has the opportunity of introducing his own I/O driver into the operating system, if he wants to use special peripheral equipment, and if these drivers are programmed according to specified guidelines. To prevent continuous blockage of the storage location for rarely used I/O drivers, the generating process can integrate several I/O drivers into the system so that they are loaded into the working storage with a command only as they are needed.

The following devices are serviced by MOEX 1600:

With Edition 1.1

display screen input/output unit (operating unit) - K 8911
Cassette disk memory - CM 5400
paper tape unit - K 6200
paper tape unit - CM 6204
cassette tape unit K 5261
tape unit - CM 5300
serial printer - Robotron 1152
serial printer - Robotron 1156
parallel printer - VT 27060/65
universal display screen terminal - K 8931, only through IFSS.

With Edition 1.2, the following will be added:

display screen input/output unit K 8912
universal display screen terminal K 8931, both through IFSS or V24, MODE
serial printer - Robotron 1157
floppy disk unit - K 5665
punched card reader - K 6100
tape unit - CM 5303
telex - T 51/T 63
process input/output equipment - Ursadat 5000
digital plotter
digitalizing unit (physical operation)
BUS coupling unit - BKE 1600-1500, BKE 1600-1520
(thus connection of remote data processing peripheral multiplex 8523 and the like).

As minimum peripheral equipment, an operator unit is required and for operating systems that are resident in external memory a cassette disk memory as system residence. Unless a lower limit is specified by the MRS K 1600, the executive routine can support at most 16 devices or device control units of one type.

The operating system MOOS 1600 is generated according to the special requirements of the user. The generation takes place in three segments, which are controlled by the generation specifications. The first segment is implemented by the Sales Department of the VEB Combine Robotron, but the user can use the other two segments at any time if he has available a computer system with cassette disk memory.

The part of the executive routine that is resident in working storage is assembled from source modules during the first segment, is conditionally assembled, and is stored in a machine-code file. In the second segment, the parts of the executive routine (among others, the command program), which are required by the user and which have been organized as a task, are built up as a machine-code file and are linked with the part that is resident in working storage. The partition specifications are also made.

In the third segment, it is possible to build up the system programs as machine-code files.

The minimal variant of that part of the executive routine that is constantly present in working storage requires 6 K words. In addition, a 2-K-system partition and a user partition of at least 14 K words are required with edition 1.1 and at least 8 K words with edition 1.2, for the system programs.

5. Overview of the BS LAOS 1600

The BS LAOS 1600 is a single-user real-time operating system resident on disk storage.

A macro assembler, a BASIC interpreter, as well as a FORTRAN-IV compiler are available in the operating system. The system programs of the operating systems support the production of the program, the program testing, the mass storage, and the library management, as well as data transport between arbitrary devices.

Typical applications, such as the real-time acquisition of laboratory or experimental data in the foreground and the processing of these data in the background, or the processing of scientific-technical programs in the foreground and program development in the background, can be effortlessly executed with LAOS 1600, if the size of the working storage is suitable.

The following devices are services by the executive routine of the BS LAOS:

display screen input/output unit (operating unit) - K 8911
cassette disk memory - CM 5400
serial printer - Robotron 1152
parallel printer - VT 27060/65

paper tape unit - K 6200/CM 6204
cassette tape unit - K 5261
floppy disk unit - K 5665
tape unit - CM 5300
display screen input/output unit - K 8912
process input/output device - Ursadat 5000
connection control for S2 interface.

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GERMAN DEMOCRATIC REPUBLIC

DEVELOPMENT OF PROBLEM-ORIENTED SYSTEM DOCUMENTATION FOR K 1600

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 17 No 9, Sep 80 pp 21-25

/Article by Dr Erika Horn, VEB Robotron Center for Research and Technology, Dresden: "Technology for Development of Problem-Oriented System Documentation"/

/Text/ The POS (Problem-Oriented System) technology is generated according to a uniform fundamental design for the computer systems produced by the VEB Combine Robotron (electronic data processing systems of the ESER (uniform electronic data processing system), microcomputer systems, minicomputer systems). The fundamental design is set down in the so-called framework technology for POS development. This framework technology regulates the progress of the POS development process and the fundamental logic of the POS development. Furthermore, it comprises all computer-independent means of POS technology. The POS technology of the K 1600 is also based on the framework technology. The development process of the POS is regarded as a technological process. The POSs are developed through several process stages (design, implementation, test). The result consists of tested module components, modules, programs, and program systems, including the associated documentation.

The process of POS development and maintenance is subdivided, according to activities, into

the main processes: design, implementation, and testing, and

secondary processes: documentation, management, and control.

The main processes here occur in a sequential time sequence and are penetrated and overlapped by the complementary secondary processes.

1. Definition of Objectives and Problems for Problem-Oriented System Documentation

Here belong the following:

objectives and tasks of the POS product being developed
information and data
conditions and characteristics
technical preconditions, etc.

Design

During the design stage, a problem solution must be worked out for a given objective and problem definition, and this must be fixed and documented as the system design of the POS.

Depending on the objective and problem definition, the design process is subdivided into two stages, in the interest of the reusability of solutions:

Problem-Oriented Draft

Result: problem-oriented system draft (problem structure, including partial algorithms, data structure, execution sequence structure).

Program-Oriented Draft

Result: program-oriented system draft (structure as a hierarchy of programming units, including their execution control, data description of data internal to working storage, description of data base in the form of a description of relations and characteristics).

Implementation

In the component process of implementation, the program-oriented system draft is transformed into a program code, which can execute on a specified computer configuration K 1600 under the operating system MOOS 1600.

Testing

During the testing stage, one must verify whether the program code that was produced as the result of the implementation stage, as well as the associated program documentation, in combination with the operating system MOOS 1600 and the device system Robotron K 1600, fulfill the objective and problem definition.

Management

It is the function of management to store, find, and maintain the POS in the development, maintenance, and application process.

Documentation

All relevant data concerning a POS product must here be set down in writing, keeping step with the process of the development of the POS product.

Control

The results and intermediate results of the development process of the POS are technologically checked, keeping step with the process execution.

For these component processes, the POS-K-1600 developer obtains a coordinated assortment of technical means with the POS technology (POST). These are subdivided into methodological and programming means.

The total work of the programming means of the POST 1600 is implemented as an open system. It is possible to fabricate from this both a closed system with a generable scope of services as well as to use individual components. The system of the programming means of the POST 1600 achieves a uniform working level (the communication level of the POST 1600) for communication between the POS developer and the computer system and between the POS developers among one another.

This is semantically independent of the programming languages and operating system variants that are available within the MOOS 1600.

The various performance ranges of the languages of the microcomputer system Robotron K 1600 (e.g. macro-assembler, CDL, FORTRAN, COBOL) and the associated compilers are thus balanced out and are raised to the level of the communication level of the POST 1600.

This primarily involves

the power power of the linguistic means
support of structured programming
test support
description of and access to the data base
technical control and security
management of POS components.

The technical means are furnished as a handbook of POS technology. Its structure, content, and handling will be reported below.

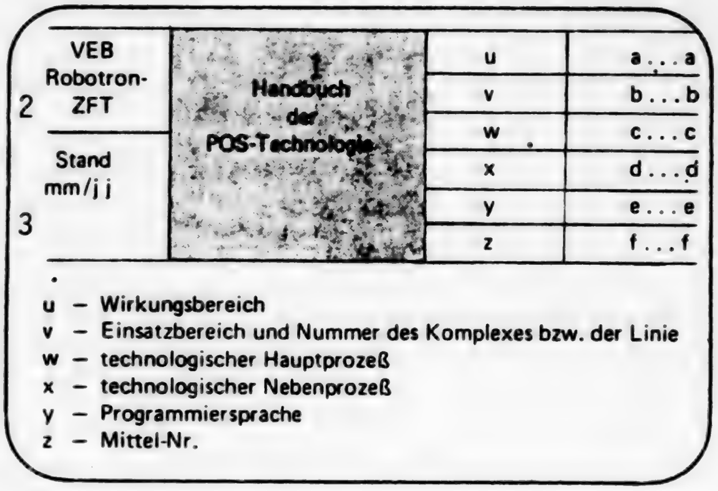


Figure 1: Classifier of the Handbook of POS Technology
Key:
1. Handbook of POS Technology
2. VEB Robotron Center for Technology
3. Status mm/jj
u - effective area
v - application area and number of the complex or of the line
w - technological main process
x - technological secondary process
y - programming language
z - means number

2. Handbook of POS Technology

The Handbook of POS Technology has a modular structure. The technological means are ordered in the handbook according to a classifier, which makes possible entry into the POS development process according to the conditions of the POS developer in the various stages of development. The classifier also represents the means for selecting and ordering the technological means (Figure 1).

Figure 2 gives a survey of the Handbook of POS Technology for the microcomputer system Robotron K 1600.

The parts of the handbook which are shown or individual combinations thereof are usable independently. The parts always contain the following:

a regulation of the course of the planning process or component process, using the means of the POS technology and the MOS - as a guideline for action

Volumes of the Handbook of POS Technology for the Microcomputer System Robotron K 1600

Classifier No.	Title
3.10.00.0.0.0	Technological line POS for K 1600 (introduction
3.10.00.0.0.1	Rules concerning the architecture and characteristics of POS for K 1600
2.00.11.0.0.1	Problem-oriented design
3.10.12.0.0.0	Program-oriented design of POS for K 1600
3.10.20.0.0.0	Implementation of POS for K 1600
3.10.20.0.1.0	Implementation of POS for K 1600 based on the macro-assembler language
3.10.20.0.2.0	Implementation of POS for K 1600 based on CDL
3.10.20.0.3.0	Implementation of POS for K 1600 based on FORTRAN
3.10.20.1.0.0	Documentation during the implementation of POS for K 1600
3.10.20.1.0.1	Formalized module documentation of POS for K 1600
3.10.20.2.0.0	Checking furing implementation of POS for K 1600
3.10.20.3.0.0	Management during implementation of POS for K 1600
3.10.30.0.0.0	Testing of POS for K 1600
3.10.30.0.1.0	Testing of POS for K 1600 based on the macro-assembler language
3.10.30.1.0.0	Documentation during the testing of POS for K 1600
3.10.30.3.0.0	Management during the testing of POS for K 1600

Figure 2: Overview of the Handbook of POS Technology K 1600

the documentation form of the results and intermediate results of the planning process.

A separate collective volume contains extensive documentation of the programming means. Generally valid methods, principles, procedures, such as the HIPO technique, structogram method, and the like, are available as independent modules of the handbook. By using the systematics of the handbook, the POS developer can assemble that assortment of technical means which he requires.

The content and handling of selected portions of the handbook will be explained below.

Introductory Writings POST 1600: Technological Line for POS K 1600

To this section belongs an introduction to the POST 1600, based on the framework technology. The objective and overall technical process are explained in accord with the conditions of the POS K 1600, and the available technological means are organized. The regulations on the

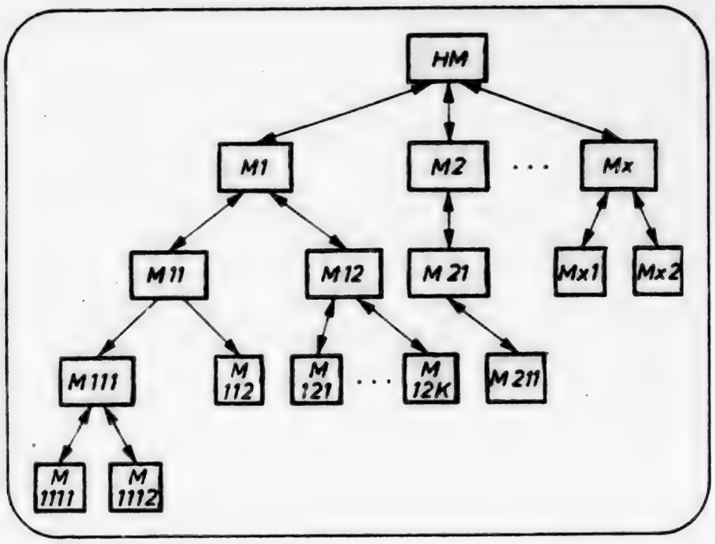


Figure 3: Picture of a Program as a College Hierarchy

architecture and properties of the POS for K 1600 are available as an independent volume of the handbook. Among the essential contents of this volume belong the fundamental concepts of POS technology:

modular design
structure block design
data design
relational design.

These designs specify that each program (program system) is through and through built up in modular fashion, on the basis of independent programming units - modules - and will have a hierarchical program structure (Figure 3).

Furthermore, it means that a POS product consists of a program base and a data base and that the communication between the program base and data base takes place on a logical level (Figure 4).

The data relations in the system are represented by means of relations.

Function-Oriented Design

This point contains the application of the principle of structured design to the design process of problem solutions. The working sequences during functional design are described. A documentation systematic is prescribed for documentation of the problem-oriented system design. The documentation

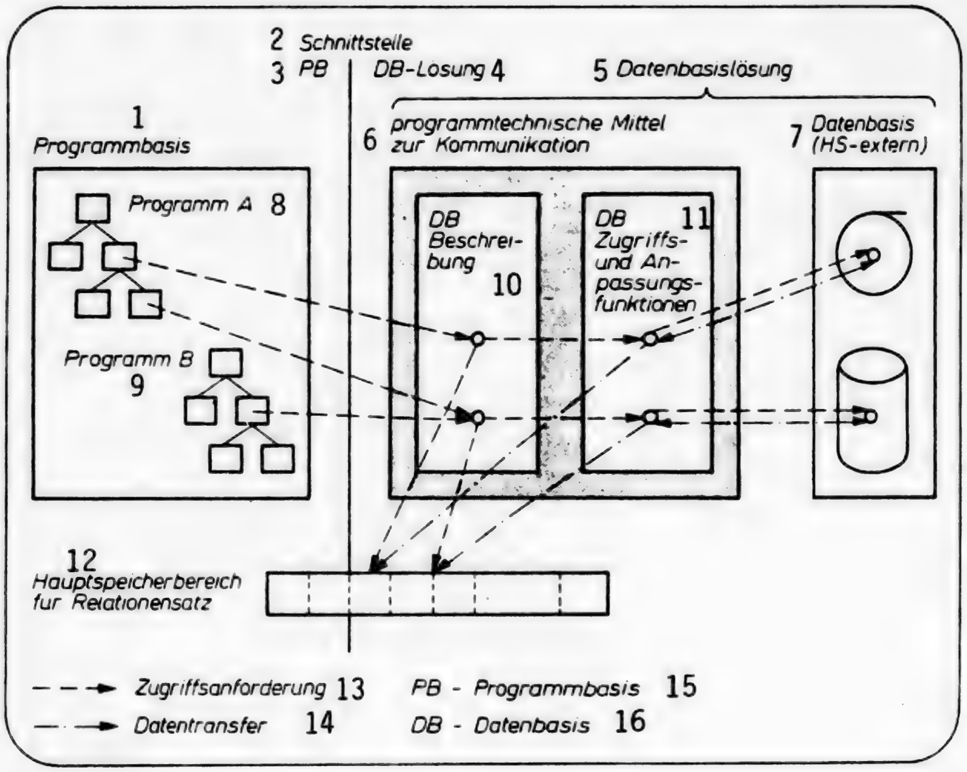


Figure 4: Interface Program Base/Data Base Solution

Key:
1. Program base
2. Interface
3. Program base
4. Data base solution
5. Data base solution
6. Programming means for communication
7. Data base (main storage external)
8. Program A
9. Program B
10. Data base description
11. Data base access and adaptation functions
12. Main storage area for relation set
13. Access request
14. Data transfer
15. PB - program base
16. DB - data base

systematic appears in a separate volume of the handbook of the POS technology. This design process is not yet computer supported.

Program-Oriented Design

The following activities are described:

- selection of the basic machine suitable for the programming solution
- specification of their types and of the record and file structure
- specification of data access
- modularization
- design of the test strategy
- planning the organization sequence of implementation and test.

The documentation corresponds to the documentation systematics.

Implementation

The language-independent documents of the implementation comprise all regulations for the general sequence of the implementation, the general description of the programming means for implementing the communication level, and the standardized module documentation.

The language-specific documents of the implementation contain the user description of the specific programming means for the respective language. Because of the significance of implementation for understanding the POS technology, there are more detailed explanations on this point.

Relative to the product, the following can be implemented:

- modules
- programs
- program systems
- data base solutions.

Standardized working sequences exist to implement these products, which are supported by programming means.

Standardized Module Structure

In order to implement the modular design, a standardized modular structure is regulated (Figure 5).

Module Interface

Each module has an interface for module linkage. POST 1600 rigidly prescribes this interface. Various interface types are possible (in dependence on the desired convenience).

Structure of a Module

	Documentation part
	Interface part at the beginning of the module
Module Body	Data definition part
	Logic part
	Interface part at the end of the module
	Data part

Specification for the Interface Parts:

Specification of the module status:	Program (task) Control module/processing module
Specification of linkability:	Internal/external External
Specification of interface type:	With/without check
Specification of the formal parameters of the module:	Name, type, repetition factor
Specification of the called modules:	Name, current parameters
Type of storage space allocation:	Static/dynamic

Figure 5: Standardized Structure of a Module

Module Linkage

This can take place on the source or object level. The linkage can be coded with special language elements.

Logical Structures

The logical parts of the modules are programmed according to the rules of structured programming, corresponding to the structure-block concept of the POST 1600.

The general sequence of the implementation process is shown in Figure 6.

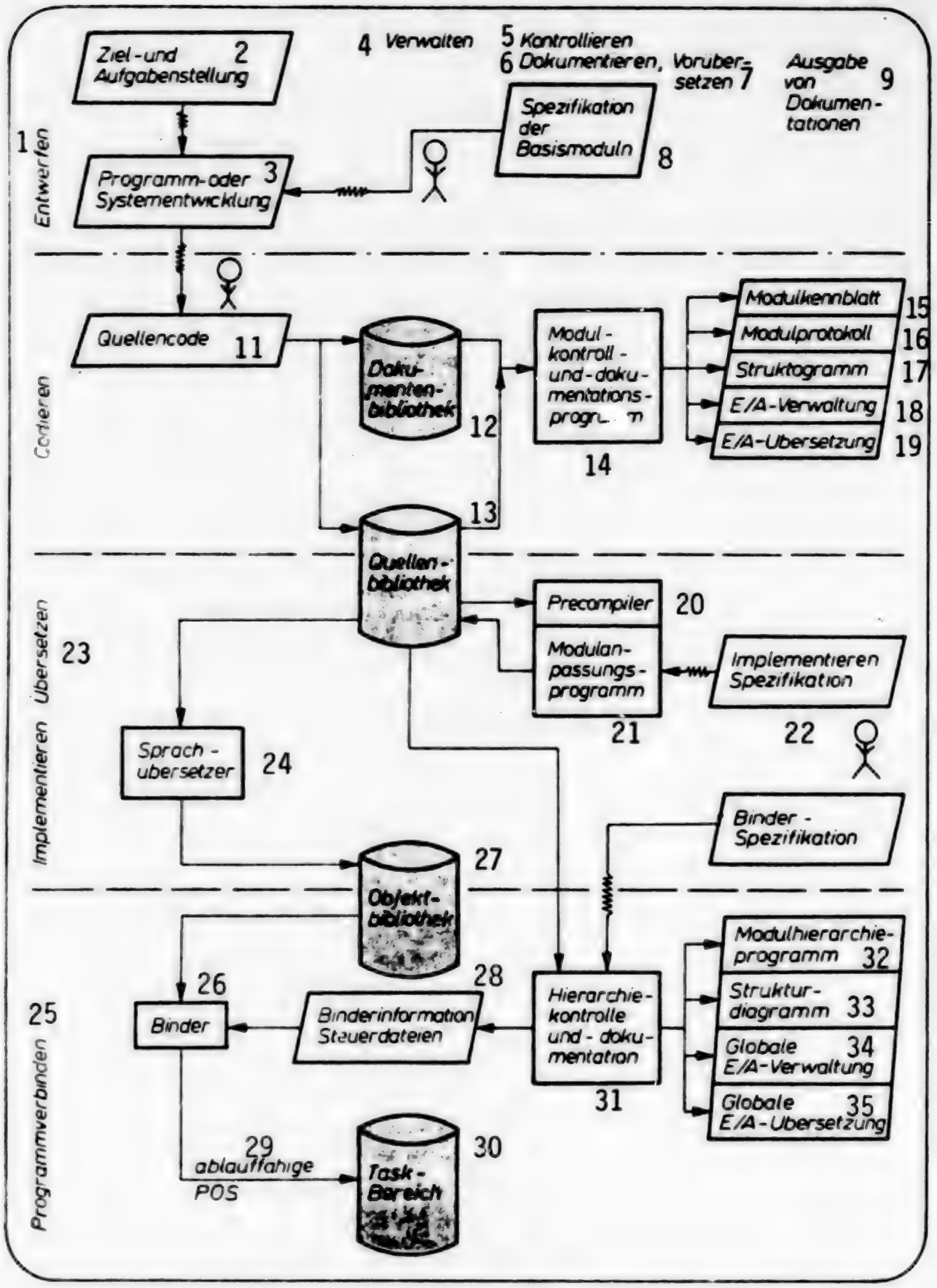

1 Entwerfen
Ziel-und Aufgabenstellung 2
4 Verwalten
5 Kontrollieren
6 Dokumentieren, Vorübersetzen 7
Ausgabe von Dokumentationen 9
Spezifikation der Basismoduln 8
Programm-oder Systementwicklung 3
Codieren
Quellencode 11
Dokumentenbibliothek 12
Modulkontroll- und -dokumentationsprogramm 14
Modulkennblatt 15
Modulprotokoll 16
Struktogramm 17
E/A-Verwaltung 18
E/A-Übersetzung 19
13
Implementieren Übersetzen 23
Quellenbibliothek
Precompiler 20
Modulanpassungsprogramm 21
Implementieren Spezifikation 22
Sprachübersetzer 24
Binder-Spezifikation
Objektbibliothek 27
25 Programmverbinden
Binder 26
Binderinformation Steuerdateien 28
Hierarchiekontrolle und -dokumentation 31
Modulhierarchieprogramm 32
Strukturdiagramm 33
Globale E/A-Verwaltung 34
Globale E/A-Übersetzung 35
29 ablauffähige POS
Task-Bereich 30

Figure 6: Sequence of the Implementation Process

Key:

1. Design
2. Objective and task definition
3. Program or system development
4. Management
5. Checking
6. Documentation
7. Preliminary translation
8. Specification of basic modules
9. Output of documentation
10. Coding
11. Source code
12. Document library
13. Source library
14. Module checking and documentation program
15. Module identifier sheet
16. Module log
17. Structogram
18. I/O Management
19. I/O translation
20. Precompiler
21. Module adaptation program
22. Implementation of specification
23. Implementation of translation
24. Language translator
25. Program linkage
26. Linkage editor
27. Object library
28. Linkage information, control files
29. Runnable POS
30. Task area
31. Hierarchy control and documentation
32. Module hierarchy program
33. Structure diagram
34. Global I/O management
35. Global I/O translation

The Three Main Phases of the Implementation Process:

coding the draft in the selected programming language according to the regulations of the POST 1600

translating the source programs into object programs

linkage of object modules.

This sequence must be adhered to, since the next following phase is always based on the intermediate results of the preceding phase. The implementation is possible both according to a top-bound and according to a bottom-up mode of procedure.

The programming means of coding are made available in the form of macros for the macro-assembler language of the Robotron K 1600. Figure 7 provides an overview of the macro assortment of the POS technology.

Macro Assortment

Macros for interface
TS ANF - Implementation of the standard beginning of a module
TS INT - Description of data which are transmitted through the interface
TS END - Implementation of the standard end of a module
TS CALL - Call of a module, module linkage

Macros for logical basic structures of the sequence control
TS IF, TS WHIL, TS UNT, TS ZYKL, TS CASK, TS CASG, TS BREA, TS MAB

Macros for error treatment

Macros for the combining of internal data

Macros for desribing the data base
TS RELV - Linkage macro for integrating a data base description in a module
TS RELD Description of a relation
TS MERK Description of a characteristic of a relation

Macros for closing disk files

Object Modules

Module for input and output
Modules for converting data records
General object modules

Figure 7: Macro Assortment for Coding

With the higher programming languages, language instructions and associated precompilers fulfill these functions.

The coded modules are checked with the programming means of the POS technology and are stored in libraries (source and documentation library).

Before translation with the compiler or assembler, the precompilers or macro-adaptation programs must be run through, and these have the following functions:

transformation of the language means of the uniform communication level into the carrier language

checking the source text for syntactical, formal, and structural correctness, and outputting corresponding module logs.

The prepared modules are translated with the compilers and assembler. The required source text libraries and user areas can be linked automatically. As a result, the object modules are stored in the object module library. Then follows the individual test of the modules.

During program linkage, the object modules are converted into runnable machine code. Only the highest module (top module) is always specified; all other modules are added automatically. The necessary input streams into the linkage editor are prepared by an auxiliary program. At the same time, a documentation of the module hierarchy is worked out.

The generated task-image files are stored in user areas and can be called by the operating system. Programming means of the POS technology control the entire sequence of the implementation process.

Testing

The documents on testing for POS K 1600 comprise the general principles and methods of function tests. A general technical sequence is set down as a regulation for the functional test (Figure 8).

This sequence holds for all types of the POS product (module, program, program system, data base).

Numerous test means are available which primarily support the test sequence according to the top-down mode of procedure.

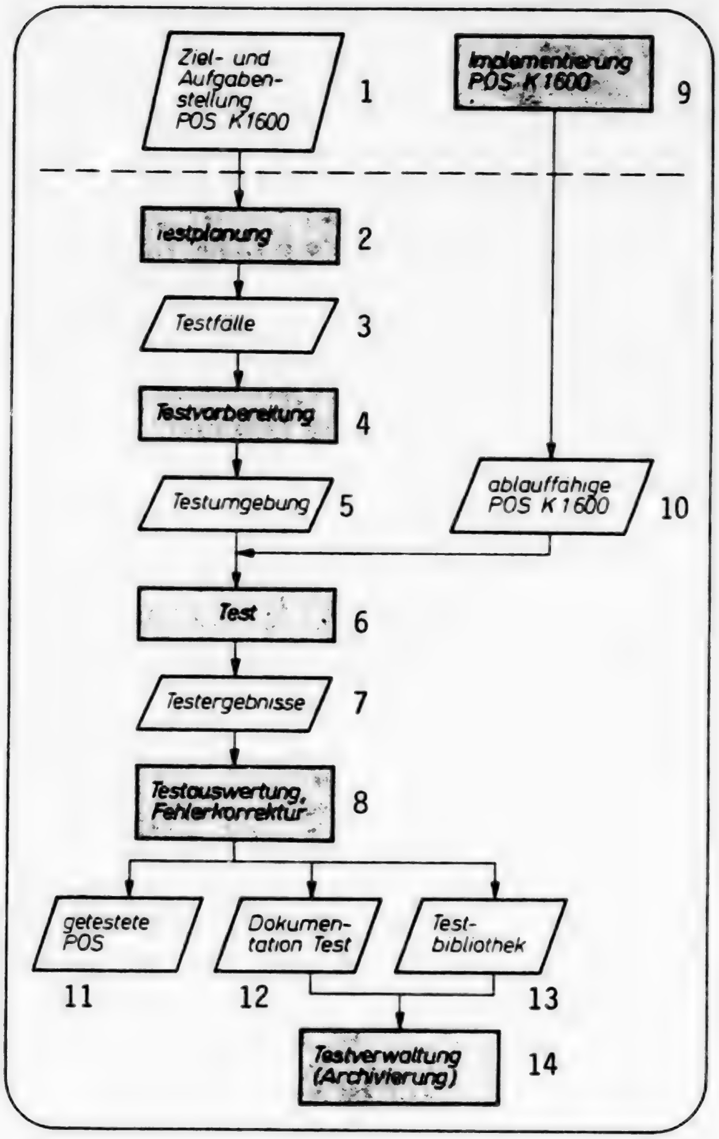


Figure 8: Sequence During Testing
Key:

1.	Objective and task definition POS K 1600	8.	Test evaluation, error correction
2.	Test planning	9.	Implementation POS K 1600
3.	Test cases	10.	Runnable POS K 1600
4.	Test preparation	11.	Tested POS
5.	Test environment	12.	Documentation test
6.	Test	13.	Test library
7.	Test results	14.	Test management (filing)

3. Prefabricated POS of the Microcomputer System Robotron K 1600

These prefabricated POSs K 1600 are reusable program units, fabricated according to the POS technology, by means of which universal or frequently recurring POS functions can be solved when the Robotron K 1600 microcomputer system is used. Figure 9 gives an overview of the assortment of prefabricated POST K 1600.

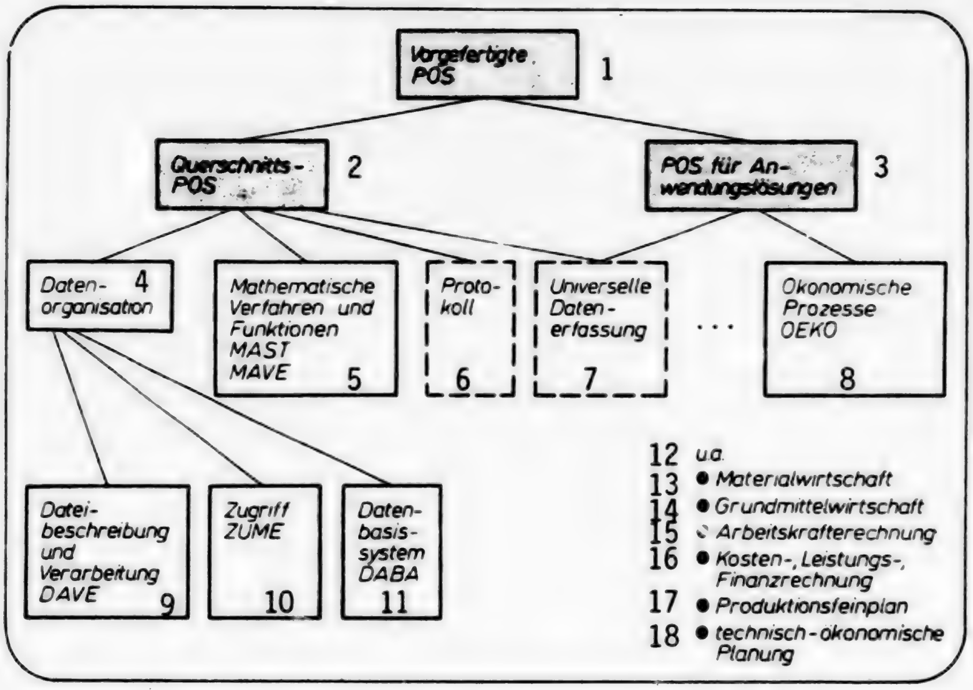
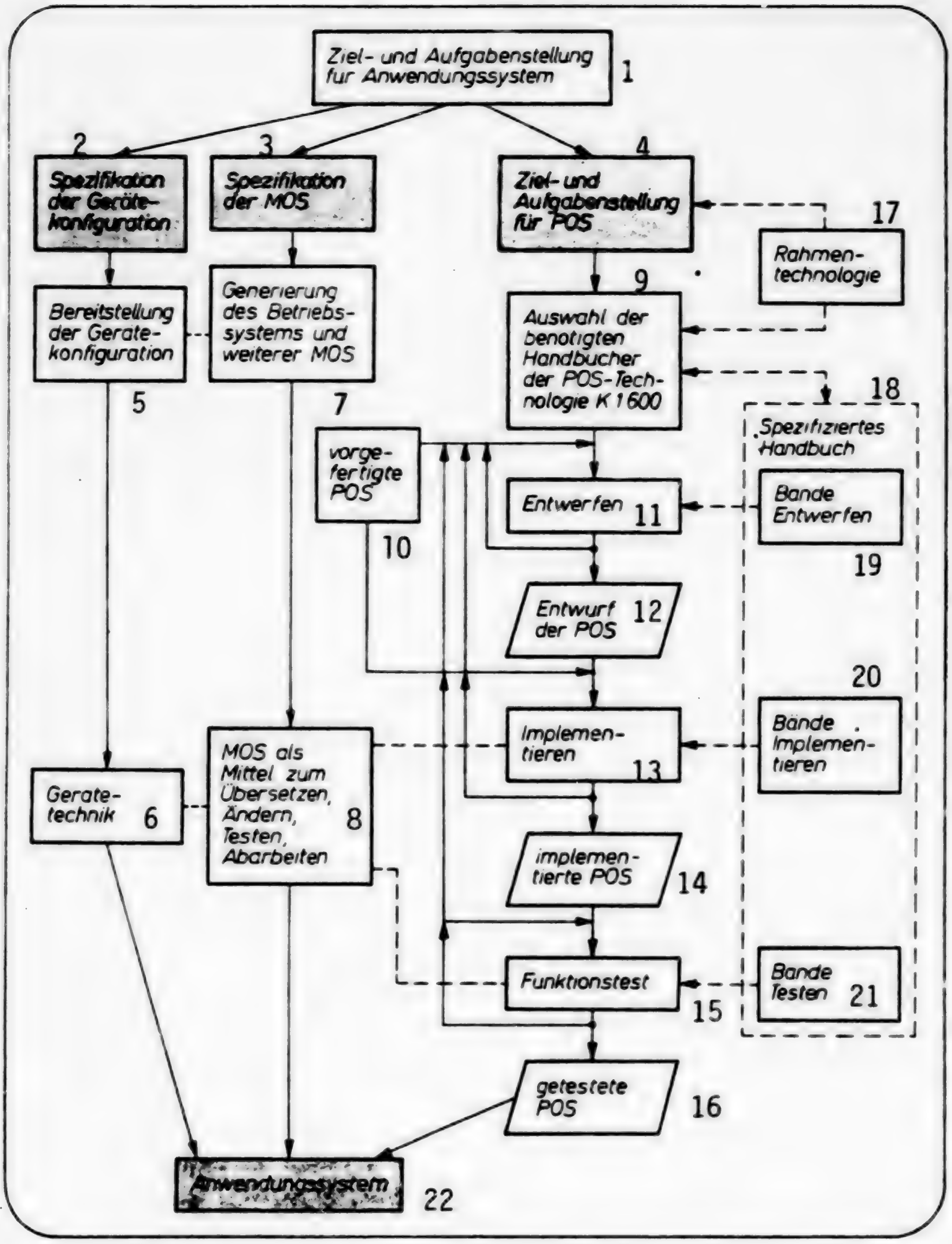

Vorgefertigte POS 1
Querschnitts-POS 2
POS für Anwendungslösungen 3
Daten-organisation 4
Mathematische Verfahren und Funktionen MAST MAVE 5
Protokoll 6
Universelle Datenerfassung 7
. . .
Okonomische Prozesse OEKO 8
Dateibeschreibung und Verarbeitung DAVE 9
Zugriff ZUME 10
Datenbasissystem DABA 11
12 u.a.
13 ● Materialwirtschaft
14 ● Grundmittelwirtschaft
15 ● Arbeitskrafterechnung
16 ● Kosten-, Leistungs-, Finanzrechnung
17 ● Produktionsfeinplan
18 ● technisch-okonomische Planung

Figure 9: Prefabricated POS of the Microcomputer System Robotron K 1600

Key:

1. Prefabricated POS
2. Cross section POS
3. POS for application solutions
4. Data organization
5. Mathematical methods and functions, MAST, MAVE
6. Log
7. Universal data acquisition
8. Economic processes OEKO
9. Data description and processing DAVE
10. Access ZUME
11. Data base system DABA
12. etc.
13. Materials economy
14. Basic means economy
15. Work force calculations
16. Cost-, performance-, financial-calculation
17. Fine production plan
18. Technical-economic planning



Ziel- und Aufgabenstellung fur Anwendungssystem
1
2
Spezifikation der Geräte-konfiguration
3
Spezifikation der MOS
4
Ziel- und Aufgabenstellung für POS
17
Rahmen-technologie
Bereitstellung der Gerate-konfiguration
Generierung des Betriebs-systems und weiterer MOS
9
Auswahl der benotigten Handbucher der POS-Tech-nologie K 1600
5
7
18
Spezifiziertes Handbuch
vorge-fertigte POS
Entwerfen
11
Bande Entwerfen
10
19
Entwurf der POS
12
20
Implemen-tieren
13
Bande Implemen-tieren
Gerate-technik
6
MOS als Mittel zum Übersetzen, Ändern, Testen, Abarbeiten
8
implemen-tierte POS
14
Funktionstest
15
Bande Testen
21
getestete POS
16
Anwendungssystem
22

Figure 10: General Sequence for POS Development

Key:

1. Objective and task definition for application system
2. Specification of the device configuration
3. Specification of the MOS
4. Objective and task definition for POS
5. Furnishing the device configuration
6. Device technology
7. Generating the operating and further MOS
8. MOS as means for translating, changing, testing, processing
9. Selection of the required handbooks of POS technology K 1600
10. Prefabricated POS
11. Design
12. Designing the POS
13. Implementation
14. Implementing the POS
15. Function test
16. Tested POS
17. Framework technology
18. Specified handbook
19. Design volumes
20. Implement volumes
21. Test volumes
22. Application system

4. Working Sequence of POS Development by the User

The following basic configuration is required for the POS-K-1600 development by means of the POST 1600:

a K 1620/K 1630 with at least 32 K words working storage
an operating unit
two cassette disk memories
a printer
a cassette tape unit or a paper tape unit
the operating system MOOS 1600.

Figure 10 shows the general sequence of POS development by the user, using the MOS, the POS, and the POS technology.

The VEB Combine Robotron handles the marketing of the manual of POS technology. The POST 1600 can also be used on the computer systems of the SKR (State Committee for Nonmetallic Raw Material Reserves), which are compatible with the computer system Robotron K 1600. The RD (Rechentechnik/Datenverabeitung) supplement 3/1980 gives further references to the POS technology.

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HUNGARIAN RESULTS IN TECHNICAL REALIZATION OF TELETEXT, VIEWDATA

Budapest MERES ES AUTOMATIKA in Hungarian Vol 29 No 6, 1981 pp 206-211

[Article by Sandor Klein and Lajos Nobik, ORION Radio and Electrical Enterprise]

[Excerpts] The Teletext and Viewdata systems are spreading increasingly over the whole world. This article provides basic technical information and describes the possibilities of hardware realization. The last section of the article discusses the current development status in Hungary and outlines Hungarian application.

Results of the Technical Realization of Teletext and Viewdata in Hungary

Experts have followed developments carried out at the BBC and IBA companies ever since the promulgation of the first draft standard for Teletext. The OMFB [National Technical Development Committee] coordinates and directs the theme. Matters related to realization in Hungary were examined in the analytical study entitled "Domestic Application Possibilities of TV Data Systems," published in 1978. The RTV [Radio and Television Section] of BME [Budapest Technical University]-HEI [expansion unknown] took a major part in preparing the study and also in the research involved. A proposal was submitted for the realization of characters with diacritical marks for the Hungarian language — a problem that has received no attention until then. The study also outlined the possibilities for the setting up of a Teletext editorial facility, and examined the interfering effects of the Teletext signal on program broascasting. In 1979, at the request of the OMFB, a study was prepared at the university on the construction of a microprocessor-based Teletext editorial terminal. Among the Hungarian manufacturers of TV equipment, ORION was the first to assess the requirements for the new system, which included major modifications of television equipment. A Teletext decoder board with the corresponding infrared telecontrol unit, made by Mullard, was installed in a color television receiver CT 451, as early as 1978, at BME-HEI RTV at the request of ORION. A static Teletext page generator was also prepared at the university for testing the decoder and its possible manufacturing control, also at the request of ORION. The page generator has the capability of inserting preprogrammed Teletext pages in response to a video signal. All decoder functions can be checked with the aid of these pages. As a result of further development at ORION, this page generator can now store 50 pages of fixed information (compared to 12 pages initially). In addition, several dissertations have dealt with this subject, which, in addition to clarifying various aspects of the theme, contributed to the training of the experts required for the introduction of this new technique.

The use of the Teletext system in education is investigated at the National Education Center (OOK) in Veszprem. There. a complete editorial system made by Aston permits the editing of Teletext pages.

The Hungarian Postal Service is seriously interested in the engineering aspects of Teletext transmission, and -- in cooperation with the university -- made a trial transmission in December 1980. We shall report on the results of this experiment at a later time. Both Videoton and ORION produced color television receivers for Teletext reception in the course of the experiment. With the aid of these receivers, the error percentage of the Teletext signal was evaluated in various geographic locations, and the kind of interferences on program broadcasting was investigated.

The Viewdata system also has major potential. At the request of OMFB, the university developed an experimental Viewdata terminal based on the ABC-80 microprocessor. As a result of the cooperation between ORION and the university, a decoder capable of receiving both the Teletext and Viewdata signals will be installed in a color television receiver in early 1981. At the same time, a "Teletest" test unit will be developed at ORION to carry out detailed checking of already installed Viewdata decoders.

Development of the computer network of Viewdata is obviously a major task. It is useful to know that there is enterpreneurial interest from two sources for this already.

Application Possibilities in Hungary

In Hungary, it is expected that the first use of the Teletext video transmissions will be in the field of education; both centrally transmitted and locally (at local Teletext centers) produced programs could contribute significantly in audiovisual training. A data recorder and an audiofrequency cassette with a small central Teletext data adapter could be particularly useful in this field; this would permit the prefabrication of full program packets for use at any place and any time.

The Viewdata system seems to be the better of the two for setting up a closed-circuit system. Many administrative problems could be simplified by its use. In Hungary, public administration would be a closed system where this could be implemented. The various regulations, laws, land-registry records, birth/death/marriage registry records, and other centrally administrable data could be handled and retrieved. By using a simple printer attachment, hard copies could be readily provided.

Teletext transmission for the general public has even greater potential.

In addition to broadcasting simple daily news material, weather forecasts, road reports, and timetables could be broadcast. Various schedules of entertainment events could be provided for those seeking ways to spend their free time. Various games could be broadcast via Teletext Fig. 5).

Commercials or specific product information could be transmitted; this would be of interest to commercial enterprises (Fig. 6).

Subtitles could be superimposed on various programs with Teletext to help those with hearing impairment. This would meet an existing social need. If this were provided, the involved individuals could enjoy television programs, while not creating a nuisance to those viewers who do not require the subtitles. The study of foreign languages would be facilitated by the superimposition of Hungarian text to foreign films, which could be broadcast with the original soundtrack. Teletext could supply the text.

With minor modifications, this system could provide news and the experience of an edited journal to blind persons. Visualization of ASCII characters on Braille typewriter is an already developed procedure. With the aid of a Braille typewriter coupled to the decoder memory, the requested page could be made to appear in a form in which blind persons could use it.

The Viewdata system could offer additional services for the general public. Contrary to the Teletext transmission, the number of stored pages is virtually unlimited in Viewdata; thus, instead of daily news bulletins direct connection could be established between the user and the computer, so that large amounts of information would be available for recall. By making use of this interactive capability, goods may be ordered after viewing of a commercial; and trips, theater tickets, and the like could be directly ordered.

Fig. 5. "Mastermind" television game
(an example of entertaining games)
[Figure not reproduced]

Fig. 6. An example of product-information
The photographs were taken from the screen of an ORION CT 452 color television receiver; the TV newspaper pages were created with the Teletext generator described in the text. The black-and-white reproductions here cannot do justice to the real experience of viewing the original transmission.
[Figure not reproduced]

It would even be possible to establish message traffic among subscribers; for individuals with hearing impairment this could replace telephone communication. There is room for further development if a full keyboard is attached to the Viewdata unit. Using the domestic TV receiver as the display unit, a small computer could be created. Original user programs could be written and, in addition, user programs could be retrieved from the central memory. Easy training in computer technology could be provided in the same manner, by recalling various game programs.

Of course, an internal RAM memory of 1 K capacity would then no longer suffice; the addition of a cassette-type data tape recorder would be required.

Conclusions

The situation in Hungary differs from the situation abroad in many respects. Broadcasting of programs for the general public is likely to be preceded by the establishment of relatively small closed-circuit systems: The domestic conditions do not justify as yet the publication of a general-purpose television newspaper. Research and experimental work in Hungary is primarily based on the English Teletext system. Hungarian-language characters with diacritical marks can be realized in this system already, and special decoder integrated circuits are commercially available. In addition, this system is already in use in several countries. The Hungarian Postal Service deserves commendation for its efforts to clarify the technical prerequisites of transmission by means of experiments. However, an essential condition for a TV newspaper is the setting up of an editorial operation. This is delayed since there is nobody to take charge of it.

The possibility of realizing a Viewdata TV newspaper in Hungary is more remote. For example, it would be a very extensive task to develop the required software. Compared to the Teletext, the system requires the editing of much more extensive material, which necessitates the establishment of a very large organization. It is probably because of these reasons that those countries which use the Viewdata system, have purchased the licence for it.

It seems to us that, in spite of the existing difficulties, the advantages of a TV news service are so many that a way will soon be found in Hungary to realize a suitable system, and that we will be able to report on the successful completion of the experiments in the not too distant future.

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